SCIENTIFIC AMERICAN

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CHRISTOPHER COLUMBUS.

When Columbus set sail on the voyage which was to result in the discovery of a new continent, he was probably 56 years of age, though the authorities differ as to whether he was born in 1435 or 1436. He died in 1506. Born at Genoa, receiving the rudiments of a liberal education at the University of Pavia, and becoming a sailor on reaching his fifteenth year, it is certain that, before making the voyage from Palos which was to make him famous, he had already had large experience in navigation, for those times. Of himself he wrote, "Wherever ship has sailed, there have I journeyed." In his eventful career as a navigator, and in his search for aid from different courts and of wealthy patrons, that he might prosecute his idea of finding a westward passage to Asia, he had, therefore, gone through many vicissitudes, before his successful voyage made him a conspicuous figure in the closing years of the fifteenth century. This in some measure accounts for many of the differences in the narratives of his life, about portions of which there is much obscurity, as well as for the different representations of his personal appearance which have come down to us. In the SCIENTIFIC AMERICAN of May 9, 1891, appeared a portrait of Columbus, from a picture painted by Piombo, and which was for years owned by the noble Italian family of the Giovios, the original painting being now in the possession of Dr. De Orchi, of Como. This picture represents Columbus as much older than he appears in the portrait given on this page, which we reproduce from *Natura ed Arte*, of Milan. The picture is made from a painting in the museum of Vicenza, a province of northern Italy, and the home of Pigafetta, a distinguished Italian navigator. It is believed that this picture, by an unknown Spanish artist, affords one of the best representations extant of Columbus in the prime of his manhood.

CHRISTOPHER COLUMBUS.

(From an old portrait in the Museum of Vicenza, Italy, by an unknown Spanish artist.)

The first of the many celebrations planned in honor of Christopher Columbus and his great discovery took place at Palos, Spain, the little harbor from which he sailed, on August 3, the 400th anniversary of the date of starting on the original voyage in 1492. On the 2d of August a number of Spanish vessels, accompanied by several war ships of foreign nations, sailed to Palos, and Spanish and foreign delegates and the officers of the ships proceeded to the church in which Columbus received communion before sailing, to attend a religious service, commemorating the one held previous to the departure of Columbus. Only one of the three vessels being built to represent the original squadron of Columbus was ready to take part in the ceremonies of the following day, and this was the Santa Maria, shown in last week's SCIENTIFIC AMERICAN. At six o'clock on the morning of August 3, however, the little vessel was got ready for the start, although a dense fog spoiled the effect of the marine display, and when the sailors spread their canvas, there was no breeze. A line was consequently passed to her from a gunboat, and the Santa Maria was thus towed down stream, followed by the Spanish flotilla, past the monastery of La Rabida, which was decorated with American flags. Outside the bar were moored the vessels of foreign squadrons which had come to take part in the celebration, and between opposite lines of these vessels the caravel was towed, all firing salutes. Fifteen vessels of the Spanish flotilla convoyed the Santa Maria several miles to sea, after which the little vessel returned to Palos, her final departure being deferred to a later date, when it is expected that the other vessels, the Pinta and Nina, to represent the complete Columbus squadron, will be ready to accompany her.

Palos was selected as the scene of one of the principal celebrations of the Columbus year, not alone from its being the starting point of the famous expedition of four centuries ago, and to its possessing that monastery of La Rabida where Columbus received his first encouragement for his momentous project, but also to the remarkable part that Palos took in furnishing the material and men for the voyage. The selection of this instead of one of the larger and more important ports of Spain as the base of the expedition was due to a peculiar circumstance. There had recently been an outbreak or disturbance there of some kind, and as a penalty for it the inhabitants had been condemned to keep up at their own cost two caravels, with crews and arms, for the space of one year. These vessels were to be at the service of the state, ready to proceed to sea at once on receiving orders.

On the 17th of April, 1492, Ferdinand and Isabella had signed a contract at Santa Fé with Columbus for the voyage of discovery on which he was bent. It is a striking proof of his absolute confidence in his success that he made in this instrument so detailed a provision for the government of the islands and continents he expected to discover. He even took a letter of credentials to the potentates of such territories as he might reach. On the 30th of April Ferdinand and Isabella directed the authorities at Palos to have the two caravels already spoken of ready to sail within ten days under Columbus, and he was to procure a third. Orders were sent to Andalusia to furnish supplies for the vessels; the crews were to have the same wages as on men-of-war, with four months' pay in advance.

But the dread of navigating the Dark Sea, as the unknown portion of the ocean to the westward was called,

(*Continued on page 101.*)

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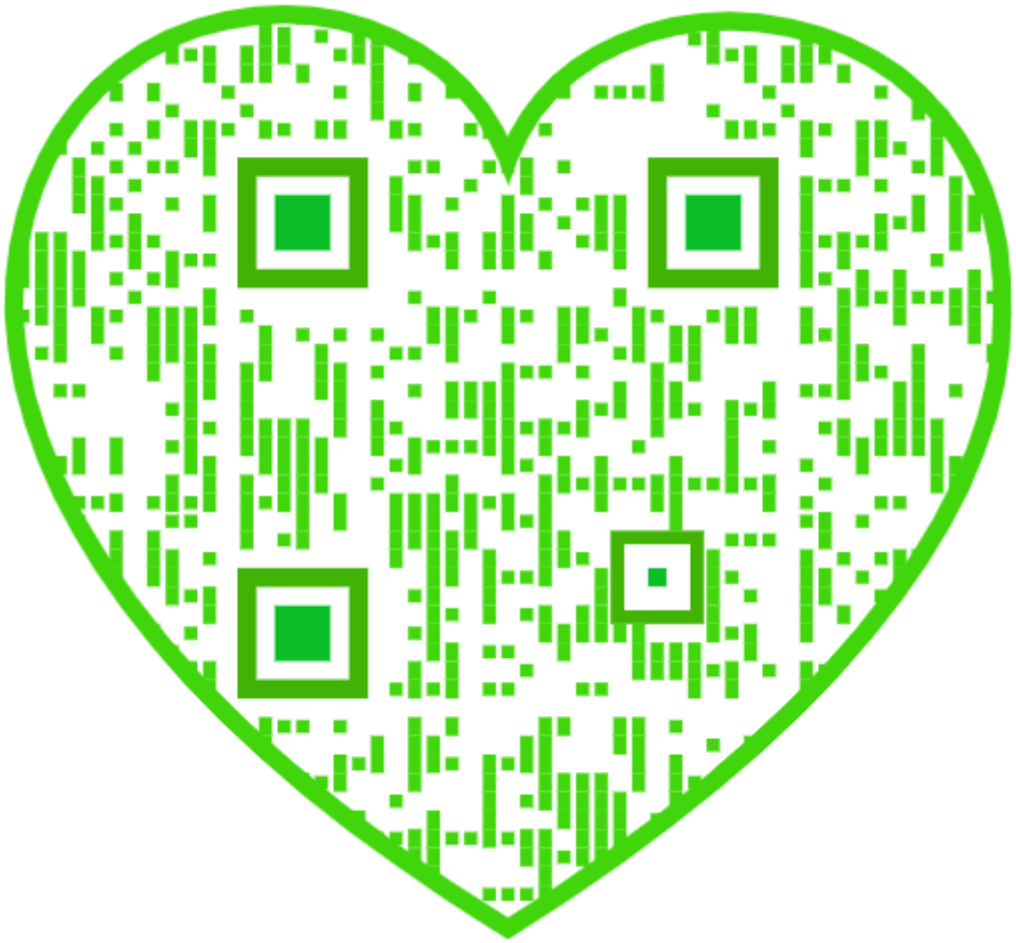

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THE APPROACHING EXPIRATION OF THE BELL TELEPHONE PATENT.

The original patent for the electrical telephone was granted to Alexander Graham Bell, of Salem, Mass., on March 7, 1876, for the term of seventeen years. The patent expires March 7, 1893. On that day it will become free to the public, and thereafter all persons will be at liberty to set up shops, manufacture the instruments described in the patent, and make use of the invention. The following are the claims of the original Bell patent of March 7, 1876:

1. A system of telegraphy in which the receiver is set in vibration by the employment of undulatory currents of electricity, substantially as set forth.

2. The combination, substantially as set forth, of a permanent magnet or other body capable of inductive action with a closed circuit, so that the vibration of the one shall occasion electrical undulation in the other, or in itself, and this I claim, whether the permanent magnet be set in vibration in the neighborhood of the conducting wire forming the circuit, or whether the conducting wire be set in vibration in the neighborhood of the permanent magnet, or whether the conducting wire and the permanent magnet both simultaneously be set in vibration in each other's neighborhood.

3. The method of producing undulations in a continuous voltaic current by the vibration or motion of bodies capable of inductive action, or by the vibration or motion of the conducting wire itself, in the neighborhood of such bodies, as set forth.

4. The method of producing undulation in a continuous voltaic circuit by gradually increasing and diminishing the resistance of the circuit, or by gradually increasing and diminishing the power of the battery as set forth.

5. The method of, and apparatus for, transmitting vocal or other sounds telegraphically, as herein described, by causing electrical undulations, similar in form to the vibrations of the air accompanying the said vocal or other sounds, substantially as set forth.

If any one should be disposed to question the policy of granting patents for new inventions, some other example than the telephone probably would be needed in order to establish the contention. It is true that a number of alarming adjectives might be arrayed against the policy of patents, as illustrated by the grant of the Bell privilege. It might be alleged, for example, as a direct result of this policy that a huge monopoly has been created, which from a single center, like a gigantic octopus, has extended its slimy members into every part of the land and fastened itself, with relentless grasp, upon the throats of the people, robbing them of their means, compelling them to submit to exorbitant and unconscionable demands.

It is true this telephone octopus sucks in millions of money every year. In New York it installs instruments within your office or dwelling, runs wires for you underground, connects you with all business people and all the centers of business, waits night and day to answer instantly your calls, and then has the unblushing effrontery to demand payment at the rate of twelve and a half dollars a month, if you live in New York—something less if you reside elsewhere. In addition to the above, this horrible octopus, if you dwell in New York, connects you on call with Boston, Albany, Buffalo, Philadelphia, Baltimore, Washington, Pittsburg, and all the intermediate villages, towns, and cities, for which it extorts such extra sums as 25 cents, or 50 cents per long distance call. This ever-growing monster is constantly extending itself, and probably, before long, New York and Chicago will be telephonically connected.

From the last annual report of the Bell Telephone Company, it appears that the number of instruments in use at the close of the year 1891 was 512,407—a large increase over the previous year. The total earnings for the year were $4,375,290. The expenses were $1,505,872, leaving the net earnings at $2,869,418.

Admitting everything that can be said against the holders of the telephone patents, the injuries resulting from the monopoly are outweighed a millionfold by the benefits conferred by the invention upon the public. It is substantially the same in respect to other new patented industries. While it is true as a general proposition that private monopolies are apt to result injuriously to the public interests, and therefore are to be avoided, still the policy that encourages the production of new inventions by the grant of temporary monopolies called patents, is found by experience to be highly advantageous to the public weal.

It is upon this foundation our patent system chiefly rests. The inventor, lured by the promise of a patent, studies and labors to produce something new and useful, and if he succeeds, the law concedes to him the poor privilege of holding his invention for the period of seventeen years—a time so short it rarely suffices for more than a slight beginning toward the perfection and introduction of the invention. The public then come in and take full possession of the invention together with the results laboriously gathered by the patentee.

Poor as are the rewards of the inventor, and short the term of his patent, there are many people who complain; and in almost every Congress there is a corps of members who try to break down the patent system, by the passage of bills to shorten the term of patents or prohibit the pursuit of infringers, thus emasculating the patent law.

Bell seems to have had at the outset, when he took his telephone patent, only a very dim idea of its value and importance to the world. A student and teacher, unacquainted with business or the formation of trusts and companies, he parted with the patent for a comparatively small consideration. The purchasers have reaped some of the fruits of his genius; but the chief benefits will now accrue to the public. The patent is about to expire, and the telephone industry is only in its infancy. The owners of the patent have only introduced it to a trifling extent. They have built a few lines in the principal towns and cities. But when, by further experience, the art of telephoning becomes better understood, thousands of instruments will be used where now there is one.

The expiration of the telephone patent throws open to the public a new invention of incalculable value to the country. Its future development and expansion must necessarily give rise to many collateral new industries, furnishing wealth and employment for thousands of busy workers.

The Advantages of Bodily Exercises.

In the *Journal of the American Medical Association* for June 4 is an interesting paper by Dr. J. Madison Taylor on the "Influence of Bodily Exercises upon Length of Life." He commences by enunciating two propositions: (1) That judicious activities of the body tend to maintain and increase its efficiency; and (2) that the hurtful effects of violent athletic competitions are popularly overrated. The first of these propositions is obvious, and he therefore chiefly deals with the second. Against the growing interest in athletic matters there are constantly urged objections to the effect that many perfectly healthy young men are injured beyond repair by strains and shocks to vital organs received in the course of training or competitive sports, even among those who avow much confidence in the value of physical exercise; yet many declare the pity of it because such havoc is wrought thereby. Instances are cited, rather vaguely it is true, of fine fellows utterly wrecked by contests on land or water, of lives cut short by overtasks at so-called sports. After pointing how important it is for medical men to define and point out dangers and urgently insist on their avoidance in such cases, Dr. Taylor proceeds to argue that even the best and wisest of medical teachers can err in opinion, and cites as an example an assertion of Dr. B. W. Richardson:

"I venture to affirm there is not in England a trained professional athlete of the age of thirty-five who has been six years at his calling who is not disabled;" and the same author as saying: "When the artificial system of training ceases, the involuntary muscles, the heart especially, remain in strength out of all due proportion greater than the rest of the active moving parts of the organism."

Dr. Taylor maintains that this authoritative statement has swayed the judgment of thousands of thinking men. He has had these views on the damage done to involuntary muscles quoted to him again and again. Such cases he considers are indeed possible, and from such causes do they come in the laborious ranks of iron workers and those who put forth in long days excessive and continued muscular exertion. Among professional athletes the heaviest strains must come, as upon the output of the most concentrated force alone comes to them honest reward. Dr. Taylor has collected the brief histories of a score of these men now living which he thinks at least illustrate how vigorous and sound such men may be even long after the age limit which Dr. Richardson has assigned to them. These histories are interesting and some of them very remarkable, and Dr. Taylor is strongly of opinion not only that the judicious pursuit of bodily exercises, either in the line of ordinary avocations, special duties, or sports, tends greatly to maintain and enhance the vigor of both body and mind, but also that the hurtfulness of severe muscular exertion, short of profound exhaustion, is merely temporary and recoverable, and that dangers to internal organs and vital centers are comparatively rare.—*Lancet.*

Phenic Acid for Sugar Beet Preservation.

Those who have attempted beet sugar making in the United States, says the *Sugar Beet*, know the difficulty of keeping several thousand tons of beets without loss of sugar, caused by second growth or by fermentation during the period roots remain in silos. If silos are properly ventilated, the difficulty may in a measure be overcome; but during our very cold winters, communication with the exterior is impossible. Experiments upon a large scale show that 70,000 tons beets may be kept in a perfect condition for several months by the judicious use of phenic acid. Cost is less than one cent per ton of beets siloted. Two and a half gallons phenic acid in 250 gallons of water are sufficient for 1,000 tons beets.

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Personal Recollections of Eminent Men.

BY DR. P. H. VANDER WEYDE.

I. General Krayenhoff, of Nymegen.

II. President Barnard, of Columbia College, N. Y.

It was my advantage to come in early life frequently in contact with eminent men, as my father was very exclusive about the people with whom he associated, and also because the city of Nymegen, by reason of its relics of antiquity and the romantic scenery of its immediate surroundings, had always great attractions for men of learning and of taste for the beautiful, who chose it either for a permanent residence or for a place of resort in summer more easy of access than any other of the kind.

My father had on the public square, called "the great market," and situated in the center of the city, a large house where he sold hats, furs, and broadcloth, and was renowned for the good qualities of his articles, so that only the best class of people came there, making the store, after the manner of certain villages in this country, often a kind of *rendezvous*, where from boyhood up I heard discussions about the newest discoveries in science, which subject had then become the favorite topic. I suppose it was because, during the preceding thirty years of tumult among the governments, people had become disgusted with politics and found a consolation and repose in science, as I have always found, and find more and more the further I advance in years. I have made that feeling my own which Whittier has so beautifully expressed in his poem entitled "My Triumph," in which he glories in the progress of his fellow-men.

One of my earliest recollections of such conversations was that one General Krayenhoff, one of my father's friends, dropped in to tell him and others present that at last a Danish professor of Copenhagen called Oersted had discovered the true relations between electricity and magnetism, which the Holland professor, Van Swinden, in Leyden, had been searching for in vain, and had described his experiments in three volumes without making that very one and simple experiment which revealed directly the true relation. All who are acquainted with the subject can easily imagine the discussion which followed.

This General Krayenhoff may be called exceptionally eminent. I met, in all my life, only one other man who was his equal in respect to learning. It was President Barnard, of Columbia College. Each of these men combined a full knowledge of the mathematical and physical sciences with a thorough study of the ancient classical literature, both could work out and explain the most intricate mathematical problem, and both could write an essay or oration in the most exquisite Latin. Krayenhoff earned, in 1786, the gold medal for a satisfactory answer to the question proposed by the French Royal Society, which was: "Has electricity, since its discovery, really contributed anything to the progress of physical science? and has its administration as a medical remedy been advantageous or hurtful to mankind?" He answered this in Latin, in a large quarto volume of 319 pages, illustrated with four large engraved plates; but the French preferred to have it translated into their language, which was done, and the work published in Amsterdam in 1786, of which he presented to me a copy with some other books (among them his own autobiography), at the occasion that I left my father's house to fill a professional calling in 1832, and which book I have before me. In later life, called for by circumstances, Krayenhoff applied his knowledge to the arts of war, while the other (Barnard) applied it during all his life to the arts of peace, chiefly to education. Both were very active workers. Krayenhoff made the triangulation of Holland, and topographical maps of details in regard to defense against foreign enemies, and the great interior enemy always threatening it, namely, inundation; he devised the means to keep the three great rivers, Rhine, Meuse, and Scheldt, which reach the ocean while passing through Holland, under perfect control, a thing which has yet to be done with our Mississippi, which, however, is a much more colossal work and will need the labor of more than one generation to study the details and devise proper means.

One of Professor Barnard's last labors was in the editorship of Johnson's Cyclopedia, which, with his learning and his knowledge of the proper men to take charge of the various topics, he made the best cyclopedia in existence, which earned very large profits for its publisher. President Barnard, while engaged at that work, requested me to write the article on the quadrature of the circle. I did so, and he was so pleased with the new and original aspect I gave to the celebrated problem that he inserted a biographical notice of myself in the appendix.

P. S.—I have no doubt that there have been other men equally versed both in science and literature, but I speak here only of my personal knowledge. Krayenhoff for some time filled the most exalted positions in the government of Holland, while Professor Barnard, who was satisfied with governing Columbia College, was considering the importance of training our future great men, not less exalted and influential than to be like Krayenhoff, Minister of War of Louis Napoleon as long as he was King of Holland, and later given the title of baron and the great cross of the Netherland lion, etc., whatever all this may amount to.

But Krayenhoff belonged to a generation passed away previous to President Barnard, whose generation is now also passing away; still it does not appear that Europe has yet advanced far enough to see the nothingness of empty titles, which the United States so wisely discard. Imagine only the idea that the president of any of our colleges was given the great cross of the American eagle, to be worn at the lower end of a sash, as is done with the Netherland lion. We leave such kind of ornamentations to the Knights of St. Patrick. C. S.

Ventilation of the Pennsylvania Tunnel, Baltimore.

The Pennsylvania is preparing to ventilate its tunnel through Baltimore by fans driven by electric motors, the current being transmitted from a power house situated near the North Avenue end of the Bolton yard. It is proposed to erect a ventilating stack and fan midway over the northern section. The work was commenced, says the *Railroad Gazette*, about two months ago, and is to be completed in October. The power house will be a brick structure 40 × 60 feet, with one end of timber covered with corrugated sheet iron, so that the building can be enlarged if necessary. The plant will include an engine, four boilers, generator and the necessary electrical apparatus. The currents for the operation of the fans will be conducted by wires, which can be run through the tunnel or above ground to the ventilating shafts. From this central power house it is also intended to light the tunnels by electricity. The ventilation will be accomplished by building a slanting subway 8 feet wide by 16 feet high from the side of the tunnel, near its top, to the foot of the ventilating stack, which, on account of the heavy foundation necessary, will be located at the side of the tunnel. At the foot of the shaft a large fan, fashioned like the blades of a steamboat propeller, will be revolved on a vertical shaft, forcing a strong upward draught. The vacuum created at the middle of the tunnel will cause the smoke and gas to be drawn from the end of the tunnel to its middle, and out the top of the stack. The stacks are to be 100 feet high and 18 feet square. Adjoining each stack a small ornamental brick house will be erected for the storage of oil and materials used in operating the system. Owing to the smoke and gas being thrown off at such a great height, and also by reason of the fan through the use of electricity being practically noiseless, the disagreeable features of using boilers and engines are reduced to a minimum. By this system it is expected that the tunnel will be cleared of smoke and gas in less than two minutes after the passage of a train. The Thomson-Houston Electric Light Company have the contract for the electrical work.

[FOR THE SCIENTIFIC AMERICAN.]

My 100,000 Sabers During our Civil War.

It may be of some interest to many readers to learn of the various processes which must be gone through in the production of an acceptable saber blade, to say nothing of the steel scabbard and brass hilts used for them, and of the troubles and triumphs of an arms manufacturer during our civil war.

Early in the commencement of our troubles I commenced the manufacture, at Trenton, New Jersey, of blades only for a firm in Philadelphia that made scabbards and hilts. At first almost anything was accepted, with little or no inspection; but as the government became supplied they became more and more particular. So I began experimenting on quality. I had a regular oak testing block made, which is on a circle of 35 inches circumference and a little less at the butt of the saber, or where its butt came. The United States required them to be struck twice over this oak block, so that the points would snap like a whip. If the blade remained bent so that it was perceptibly crooked either way it was condemned, and a small letter *c* stamped on the hilt or tang where it was fastened to the hilt by going through the hand piece and being riveted at the upper end.

They must be made of forged bars of the very best cast steel, and when finished be of certain lengths, widths, and weights to within one ounce either way, and be of a certain curvature, so as to enter and be withdrawn readily from the scabbard. We heated them in an oven to a bright cherry red, then plunged them endwise, point down, into an oil bath; and, in order to be sure of a good spring temper, they must come out so hard that no part of one could be scratched with the corner of a hard saw file, and then the temper drawn down over an open charcoal fire to a bright pigeon blue, and straightened with a copper mallet while the heat was in, and on the end of an oak block, and the proper curve bent in them edgewise in the same way. It was a big day's work for one man to harden, temper, and properly straighten one hundred in ten hours. We used the very best whale oil and kept up the carbon by using in it a quantity of resin and a little beeswax. We kept the oil bath cool by running water around a narrow tank—the water inside and out. I used salt water that I put into my oil bath occasionally with a sprinkling pot. The water would settle at the bottom, and I used a small pump to get it out.

This I found greatly assisted in getting them file-hard, as we called it, without cracking. For the first few months we lost fully half, that would not pass inspection. If they were slightly hard they broke, and that was the end of them; and if slightly soft they would stay bent, and that condemned them. So I kept trying some way of stiffening the softer ones. I found that by bluing them they were stiffened so that they would pass the test, but to polish off the bluing made them again soft. So now I must study up some way to take the bluing off without the polishing. I found that to put about a gallon of sulphuric acid in a half barrel of water, and plunge them into the acid water and rub them off quickly with a dry cloth, the bluing was removed but that the acid ate into the steel. So I arranged another tank of lime water to neutralize the acid. I then plunged the blue-hot saber into acid water, and from there into lime water, and rubbed it off quickly with a dry cloth and Viana lime dip, and I had a most beautiful polish. I fenced off a small room in one corner and carried my own key, and did this work for months and months. I at last persuaded my inspector, Mr. Massman, not to stamp *c* on the shanks, for I had found out a new way of retempering them. I finally got my work down so fine that I averaged ninety-nine out of one hundred pieces of steel that I started on. Another trouble I had was in getting just enough steel cut off to make a saber and no waste, as my hammered steel was very irregular in size. So I would stand a lot of bars on end and run them in a small dish of water until the steel displaced just so much, and then cut them off at the water mark. I got this so perfect that the pieces might vary considerably in length and yet did not vary a quarter of an ounce in weight. After nearly two years I ventured to invite my inspector into my private corner and explain to him my method. Said he, "Well, that cost you some study and ingenuity to get it up, and you are entitled to it. It is none of my business how they are made so that they pass inspection, and I believe you are now making the best saber that the government is getting."

I made thousands of fine officers' swords, some of which I received hundreds of dollars for. I made the swords for Com. Boggs, of New Jersey, who passed the rebel forts going into New Orleans, and the State paid me $800 for it. A prisoner in the New Jersey penitentiary did my finest etching and gilding. On one side of the blade for Com. Boggs' sword I had the entire resolution of the legislature etched, and on the opposite the naval battle scene of passing the rebel fort.

Finally, after over four years of the hardest labor of my life, the war closed, and all of my profits and over six thousand dollars of indebtedness, which I then owed, were in a lot of special machines, tools, and implements of no use except old iron. Still I was left with health and life, which was better than thousands of poor soldiers could say. I went to work and invented a method of inserting teeth in saws, formed a company and took considerable stock in the company for my patents; sold enough to pay all I owed, with a small competence left. My constant study brought on what was called softening of the brain. So I resigned, sold all of my interest in the company, and went to Europe for a rest and finally recovered. J. E. EMERSON.

A New Form of Gas Battery.

The remarkable way in which one branch of physical research leads to another is illustrated by the statement that has recently been made that Mr. Ludwig Mond has found a means of utilizing his discovery of the chemically active character of carbonic oxide by making nickel and cobalt separate this gas from the hydrogen with which it is mixed in the ordinary production of water gas. When the separated hydrogen is applied to strips of platinum, as in Grove's classical experiment, a powerful gas battery is constituted, which returns in the form of electricity, as is reported, 50 per cent of the total energy of the absorbed hydrogen. If the same gas were burnt under a boiler for raising steam, and the steam so made used in a first-class engine driving a good modern dynamo, the yield of electricity would not exceed 8 per cent of the fuel energy of the gas consumed, under the most favorable conditions. It thus appears that Mr. Mond has advanced another step in the way of economizing energy, not by improving the steam engine, but by going round it. Bearing in mind the admitted superiority, from the economical point of view, of the steam-driven dynamo to any form of galvanic battery yet devised, it would be a strange turning of the tables, says the *Journal of Gas Lighting*, if it were to be demonstrated, as a practical result of Mr. Mond's discovery, that the gas primary battery and the water gas producer together form a more economical apparatus for getting out the heat value of fuel into some useful form than any arrangement which has a combustion process for its starting point.

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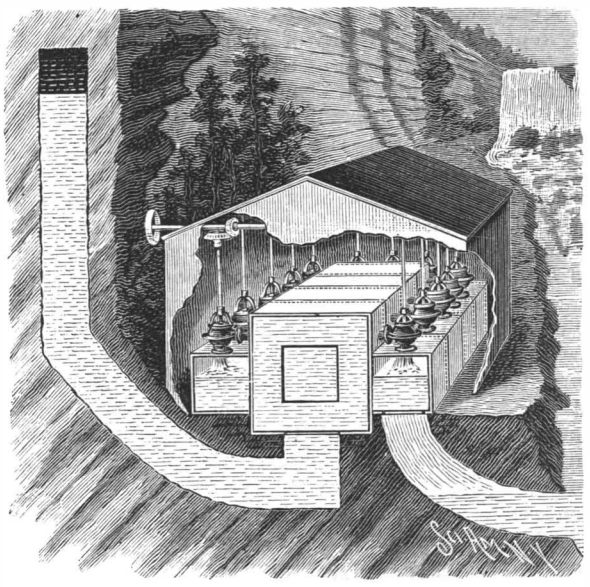
THE UTILIZATION OF WATER POWER.

The illustration represents a method of utilizing water power which has been patented by Mr. Patrick J. Dalton, of No. 341 East Ninth Street, New York City. The flume or conduit supplying the main fluid reservoir may bring the water from any practical distance, taking advantage of any available head, and this reservoir is preferably divided to form separate cubical tanks or chambers, connected with each other by central open-



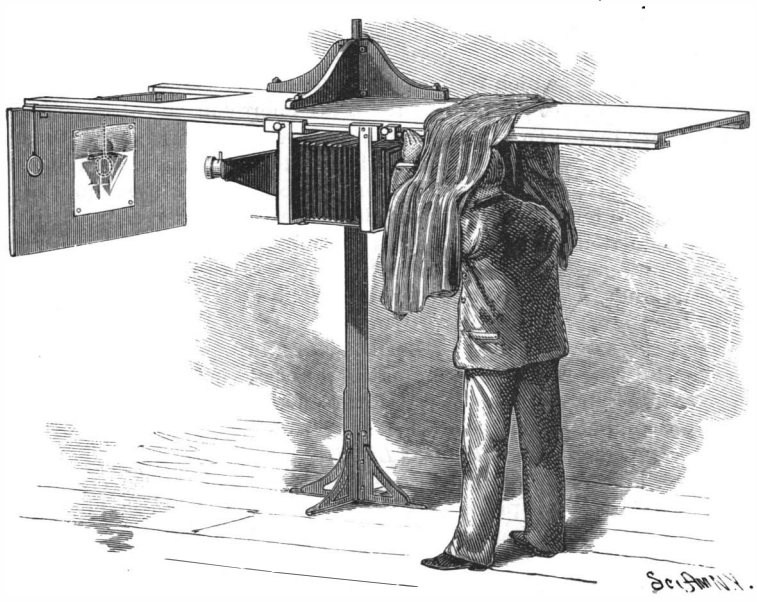
DALTON'S WATER POWER CONSTRUCTION.

ings. These tanks have their abutting walls bolted together, and their bottoms are sunk below the ground surface, while the exhaust receiving chamber is built a little higher, to surround and brace the outside walls of the reservoir. The exhaust chamber also forms a support for a series of wheels supplied from the main tank, and adapted to be geared to power-transmitting shafts, to give motion to any connected machinery. This inventor entered in the competition for the best method of utilizing the water power at Niagara Falls, with the design of having the flume consist of a tunnel from the upper rapids to the water level below the falls, after the manner shown in the view.

COPYING CAMERA HOLDER.

The accompanying illustration represents a new device for sustaining a copying camera. It was devised by a member of the staff of artists of the SCIENTIFIC AMERICAN, Mr. A. F. Bishop. It is particularly adapted for the use of photo-engravers, whose work in focusing copying cameras is very laborious and consumes much valuable time. The arrangement permits of focusing without fatigue, in the least possible time, and allows of an erect position being maintained. A wooden post three to five inches square is firmly secured to the floor with the aid of ordinary cast iron shelf brackets. The upper portion of the post terminates in an iron rod which penetrates the post sufficiently to give a firm hold. To this rod the board which supports the camera is fastened by means of strong wooden brackets. The camera board is made of well seasoned wood, preferably pine, and provided with battens upon the top to prevent warping. At the left side a T-piece is fastened, while to the right a grooved piece is attached. On this T-piece run two camera guides, one for the back and one for the front of the camera, each being provided with binding screws to hold the camera in any desired position. Guides also run in the groove at the right. The camera may be held either by pieces of wood fastened to the hangers and the front and back of the camera box or the camera may be suspended by U-shaped pieces of wood which allow the original bed of the camera to be used. The first method is illustrated, the front and back being connected by a movable brass rod in place of the bed. As the cameras used for photo-engraving are all of the wet plate type, space should be left between the top of the camera and the board to allow of the plate holder being worked with ease. The board makes an excellent holder for the focusing cloth, and by affording ventilation dispenses with much of the heat—a good feature on a warm day. At the extremity of the camera board is suspended the copy board, which is made so that it can be removed to mount the copy, but capable of being rigidly fixed at right angles to the camera board. The end of the camera board is cut out so as to allow light to fall unobstructedly on the copy board.

The ring shown upon the copy board, in dotted lines, is used to center the copy. After using it, it is thrown back to the side as represented. The camera can instantly be moved to any position on the pivot, depending upon the light. As the copy holder and camera are fastened to the same support, any vibration will be shared equally by each. The length of the board must be made according to the size of the camera. For 10 × 12 camera the length of bed should be 9 feet, while a 17 × 20 camera will require a bed 15 feet long.



COPYING CAMERA HOLDER.

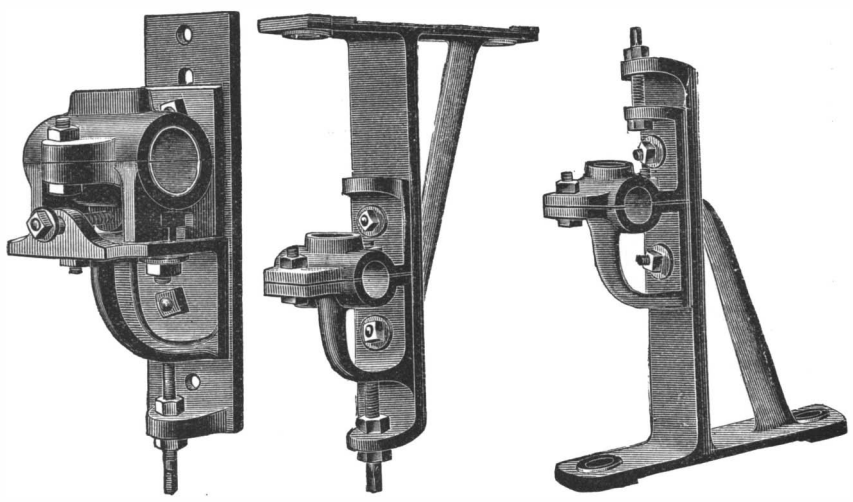
Fast Trains.

The Empire State express breaks its own record so often that close attention is required to keep track of it, so says the *Railroad Gazette*. On July 4 it ran from Syracuse to Rochester, 81 miles, in 74 minutes, equal to 65⅔ miles an hour. Thirty-three minutes' lost time was made up between Syracuse and Buffalo.

One of the regular passenger trains of the Philadelphia & Reading now runs between Kaighn's Point, opposite Philadelphia, and Atlantic City, N. J., 55½ miles, in one hour. The train has made this time regularly of late with eight cars.

AN IMPROVED HANGER.

The accompanying illustration represents three styles of an adjustable hanger, recently patented by Mr. James G. Duke, superintendent of the Memphis Machine Works, Memphis, Tenn., where the hanger is now manufactured. As will be seen, the hanger is capable of attachment to an overhead or vertical support, or to a floor stand. The box is so supported that it may be readily adjusted either vertically or laterally. The box may also be used without the hanger, being secured to any suitable available support.



POST HANGER. DROP HANGER. FLOOR STAND.

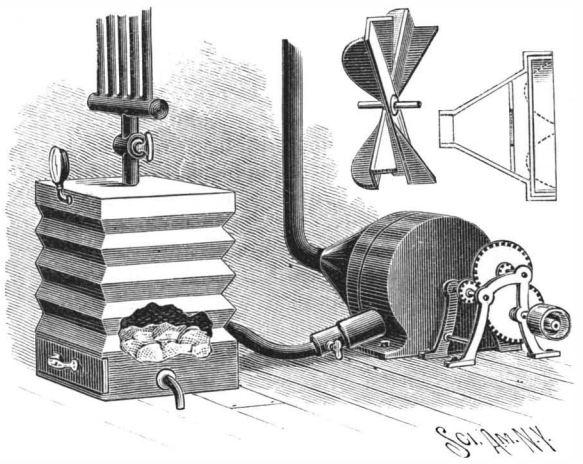
THE DUKE ADJUSTABLE HANGER.

A Famous Inventor and His Patents.

Mr. S. C. Lister the famous "silk king" of Bradford, England, and who also has silk mills at St. Denis, Rheims, and Croix, in France, has been a notable inventor, and is earnest in mechanical progress. In talking on the subject he once said, "I stand alone. Where is the man in England, or in the world, who can say, as I can say, that he has spent $3,000,000 in working out new ideas? My business life now is almost completed, and in all likelihood I shall never take out another patent, but some time ago I sent to my agent for my patent list, which I had not seen for many years. How many patents do you think were on it? A hundred and seven! All for inventions in the silk and wool manufacture! I don't suppose that is a record that can be beaten by any one. I have never gone in for anything less than $250,000 a year. I have never applied myself to any invention which before taking up I did not see was worth $250,000 a year. And I have won four! To give an illustration of what I have had to go through: When Mr. Burnley was bringing out the second edition of his book, 'Fortunes Made in Business,' I had the curiosity to make inquiries how many years I lost money in making my velvet loom a success. How many years do you think? For seven years in succession I lost heavily. All the time I had lots of people working on the loom for me. Take my wool combing patents again. I was warned repeatedly by my friends not to go in for a wool-combing machine, because everybody who attempted the task before me had been ruined, and that fate was predicted for myself. But I saw the $250,000 a year there, and in the end I won it. My silk-combing machine cost me the most, however, and I thought at one time it would be my ruin. My last partner left me, believing that it would. As you know, my idea was to work up the waste silk of India, which had never been made use of before, and could be bought in London for a halfpenny a pound. I succeeded with my inventions in the end, and have since reaped the benefit. My success, you see, is all owing to original inventions."

HAMILTON'S VENTILATING BLOWER.

An apparatus principally designed to facilitate the ventilating and cooling of different rooms in a building is shown in the accompanying illustration, and has been patented by Mr. John Hamilton, of No. 36 Hastings Street, Cambridgeport, Mass. The fan casing, shown in section in the small view, has a tapering outer portion connected with an inlet pipe, through which air may be taken from an elevation, to insure its purity. The casing is telescopic, so that the volume of air upon which the fan acts may be regulated, thus increasing or diminishing the force of the blast. The fan has blades of novel form, as shown in one of the views, each blade being composed of three parts, two of which are in different but parallel radial planes.



HAMILTON'S ROTARY BLOWER.

The fan shaft is rotated by a gear mechanism, operated by a crank handle or a driving belt, to give a rapid rotary movement. There is a cut-off valve between the fan casing and the receiver, for regulating the flow of air, and the receiver is preferably built after the manner of a bellows, so that it may expand as the air is forced into it, a pressure gauge being also provided to indicate the air pressure within the receiver. The outlet pipe from the top of the receiver connects with ventilating pipes leading to the different rooms, and in the bottom of the receiver is an icebox, over which the air passes to be cooled as it enters. The entire apparatus is portable and may be readily set up wherever desired.

Fighting Mice with a Bacillus.

Professor Loeffler's bacillary crusade against the field mice of the Thessalian plain has ended in victory. The latest reports announce that the fields are strewn with the corpses of mice. It will be remembered that Professor Loeffler discovered some time ago a new bacillus, the "bacillus typhi murium," which has the power of producing a certain disease in mice, and in mice alone. A plague of field mice, threatening to destroy the harvest, having appeared in Thessaly, he was appealed to by the Greek government, and immediately started for Athens. He began his experiments by treating field mice in the laboratory with injections of his bacillus cultivation, and when these experiments showed his method to be undoubtedly the right one, he started for Thessaly with a staff of Greek doctors. Bread crumbs, saturated with the bacillary substance, were strewn broadcast over certain fields, and as early as a week later the results were visible. Success being now assured, Professor Loeffler will return to Germany, and the bacillus cultivation will be carried on at the seat of war itself.

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AN ELECTRO-PHOTO-DETECTIVE THIEF CATCHER.

Photography has been employed in many ways in identifying and capturing criminals, but the incident which we illustrate is the first of the kind in which the thieves are made to set in operation the apparatus which is the means of their identification and capture.

Mr. Triquet, of Toledo, Ohio, had for some time missed cigars, which were taken from his show case by some clever thief, and detectives who had watched the place for several days failed to detect the thieves or to discover their mode of operation. As a last resort, the proprietor applied to Mr. W. H. Harbeck, the patentee of the flash light photographic apparatus, which we illustrate, with the hope of securing photographs which would lead to the identification of the perpetrators of the thefts.

The apparatus was set up and arranged in working order, and left to do its work. Early one morning two boys entered the place, opened the show case, and in so doing set in operation the apparatus, which made a permanent record of their deed and furnished the evidence which sent them to prison. The two lads, in the act of opening the case, closed an electric circuit, which released the camera shutter and at the same instant operated the flash light apparatus, which photographed the boys in the act of removing cigars from the case.

Fig. 1 is a correct reproduction of this photograph; in Fig. 2 the sides and end of the camera and the covering of the apparatus are removed to admit of showing the working parts more clearly. The camera is placed in a box, which is provided with a shutter operated by the spring seen at the front of the box. The shutter is furnished with an escapement which is let off by an electro-magnet. On the top of the box is arranged another electro-magnet, a vertical spindle carrying at the top a roughened disk, the electro-magnet being connected with a detent which engages an arm on the vertical spindle. In a spring-pressed holder is placed a match, which rests against the roughened disk, and above the disk is supported a flash light. Wires lead to the shutter case, and a switch is provided so that as the show case door is opened they close the circuit. The shutter of the camera is first opened by the action of the magnet connected with the escapement, and simultaneously with the operation of this magnet the detent magnet at the top of the box is operated, releasing the detent and allowing the vertical spindle to revolve, the power for this purpose being stored in a volute spring connected with the spindle. The match is ignited, and as the disk completes its revolution the match projects through the aperture and ignites the flash light powder. All this occurs in a small fraction of a second, and as soon as the circuit is opened the shutter is opened and closed and the image formed on the sensitive plate is prevented from being further acted upon. To secure the closing of the shutter, the current which lets off the igniting mechanism is taken through a fusible wire or strip of thin fusible foil located in the flash light chamber. When the flash light powder burns, the wire or foil is melted, the electric circuit is broken, and the shutter is released so as to close automatically. The effectiveness of the apparatus is clearly proved by the work it has done. It would seem that such apparatus might be concealed in banks, jewelry stores, and in other places where valuables are kept, and used as an auxiliary to the other means employed for the safety of valuable property.

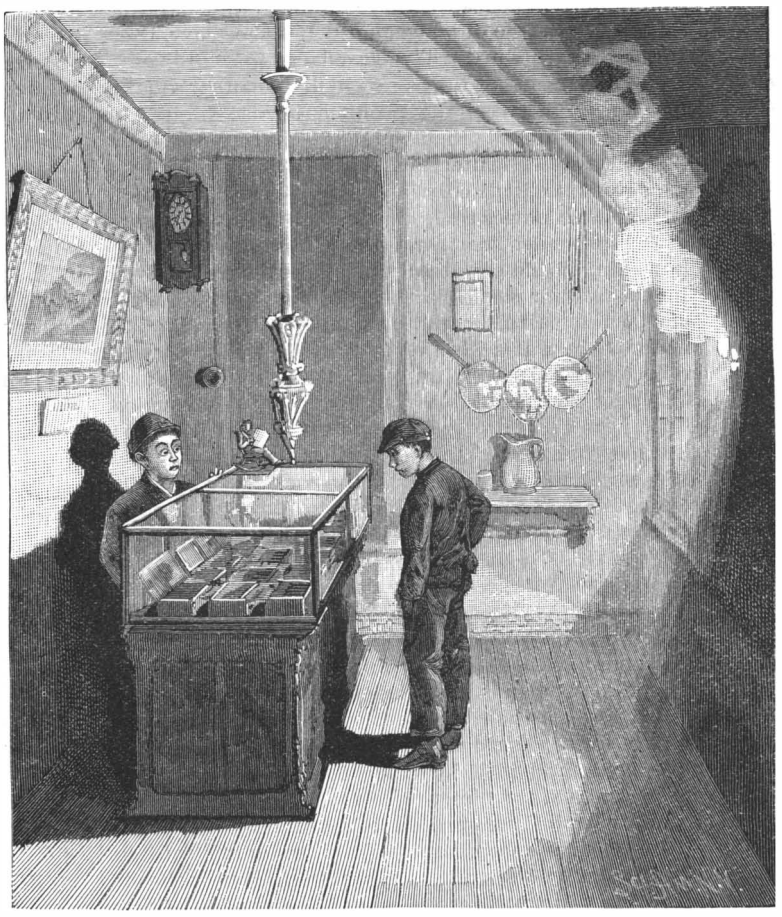

Fig. 1.—THE PHOTO-DETECTIVE.

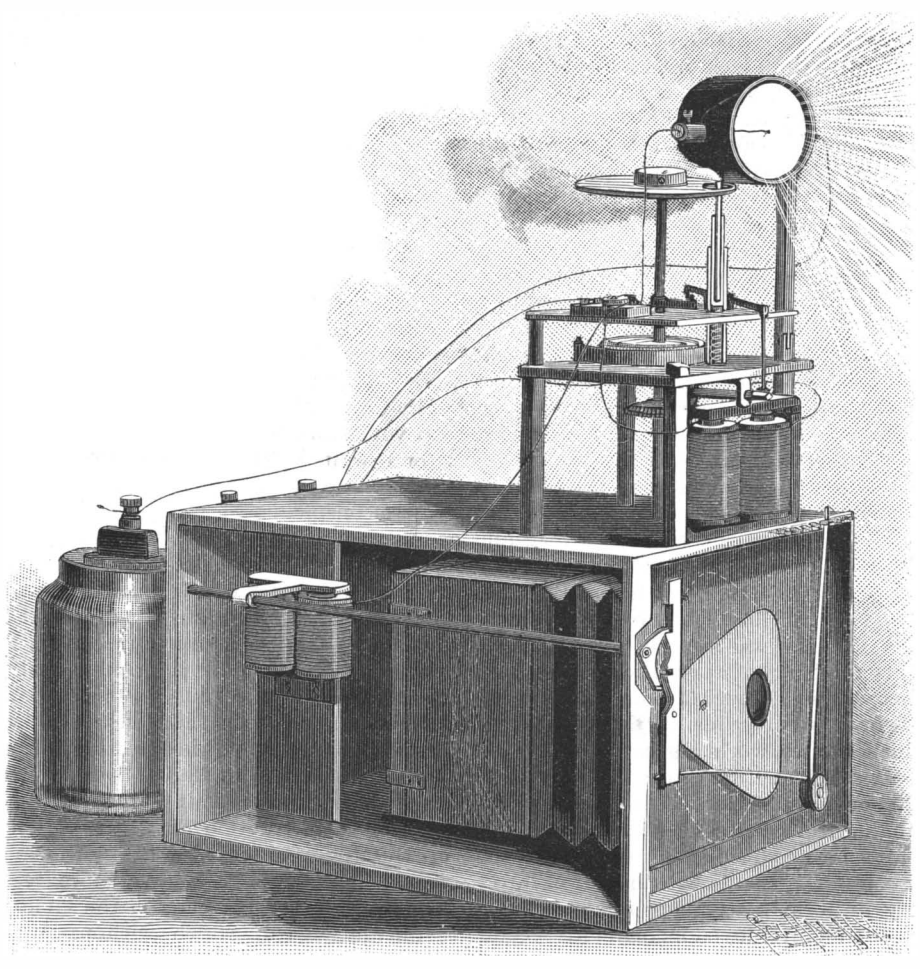

Fig. 2.—DETAILS OF THE PHOTO-DETECTIVE APPARATUS.

Ice in the Treatment of Asthma.

Dr. B. O. Kinnear regards asthma as a purely nervous disease and recommends the application of bags of ice to the spine for relief. He does not particularize the *technique* of the treatment, but, from the reports of his cases, one gleans that the applications are made from the lower cervical or upper dorsal vertebræ downward to the upper lumbar. The bags are to be kept *in situ* for periods of an hour or so at a time, and repeated three or four times daily in suitable cases. This treatment serves to equalize the general circulation, and to do away with the sufferings arising from other visceral neuroses which asthmatic patients are very apt to have. The first application, says the *N. Y. Medical Journal*, frequently gives great relief to the paroxysm.

Magazine Guns.

At a recent meeting of the Royal United Service Institution Captain Walter H. James read a paper on "Magazine Guns; their latest developments and effects." In opening his address, Captain James reminded his hearers that he delivered a lecture on a similar subject five years ago at the institute, when the nations of Europe were only on their way toward adopting a magazine rifle armament for their armies. At the present time every Continental army had adopted them, or was in course of doing so. In some, as a tentative measure, the old rifles had been adapted to magazine fire, but among all the great powers a small-bore rifle had been or was now being introduced. Germany had discarded the Mauser for a new weapon. Austria had gone over to the small-bore Mannlicher, France had the Lebel, Italy had adapted her old-fashioned Vetterli, but proposed to introduce shortly a small-bore rifle, and Russia, after some hesitation, had finally declared for a small-bore magazine rifle. The principles on which an ideal rifle should be constructed seemed to him as follows: The bolt should have a rectilinear motion, because that enabled the soldier to fire without taking the rifle from the shoulder; the magazine should be central, and should hold 10 or 12 cartridges; the cartridges should be contained in a frame, or filler, so that they can be readily loaded into the magazine; the cartridges should be easily taken from the holder for use in the weapon as a single loader; there should be a cut-off, which should be so arranged as to facilitate the use of the weapon as a single loader; and the bore should be sufficiently small to enable a long bullet to be driven at a high velocity, so that at medium ranges—*i. e.*, within 800 yards—one sight would suffice for military purposes.

Engineering Enterprise in Japan.

A large and important government engineering enterprise was recently completed in Japan. Lake Biwa, having an area of 500 square miles, is situated about seven miles from the city of Tokio, and at an elevation of about 140 feet. A navigable canal has been cut from this lake to Tokio, involving two miles of tunneling and an aqueduct of considerable length. At the eastern extremity of the city, to which point the canal has been brought, there is a sharp decline of 118 feet, from the base of which the canal is continued to the sea. This difference of level is overcome by inclined plane ways, 2,100 feet in length, on which boats are raised or lowered from one canal to the other. These ways are operated by electric power furnished from a Pelton water wheel, connected with a Sprague motor. The fall above named affords also a very valuable water power, a part of which has already been utilized for various mechanical purposes by means of electric transmission. The power station is located at the foot of the incline, and consists of three 8 feet and two 6 feet Pelton wheels, aggregating about 600 horse power, which are supplied with water from the high level canal by three lines of 36 inch pipe, 1,300 feet in length, delivering water to the wheels under a head of about 100 feet.

These wheels are at present operating three Edison dynamos of 80 kilowatts each, the power from which is distributed about the city within a radius of two miles, running rice mills, spinning mills, a watch factory, and various other machinery. One Thomson-Houston alternating current dynamo of 2,000 volts supplies the city with 1,300 incandescent lights, as well as many arc lights. The above works, involving an expenditure of about $1,250,000, were planned by and executed under the direct supervision of Mr. S. Tanabe, an eminent Japanese engineer, and they are said to be entirely successful, both from a scientific and commercial standpoint.

Uses of Resin.

There are many useful purposes, says *Engineering*, to which resin can be applied outside of those of general practice. As a non-conductor of heat it is used in the protection of water pipes, particularly in crossing bridges where the pipe is laid in the middle of a long box and the whole filled with melted resin. Resin is also used in supporting basement floors in machine shops, which may be laid over some dry material, as spent moulding sand, which is carefully leveled off, and the planking laid upon temporary supports separating it about 2 inches above the sand. Numerous holes, about 2 inches diameter, being bored through these planks, melted resin is forced through them by means of funnels until the whole space is solidly filled, and then the upper flooring is laid upon these planks. In case the floor is subjected to shocks sufficient to break the resin, it rapidly joins together again in much the same manner as the regelation of ice. Resin is also used to form waterproof paper for use in butchers' shops, fish markets and also for building purposes, and strange to say, this improvement reduces the cost of the paper. All methods of applying resin in solution after the paper is finished add heavily to its cost and also render it very brittle; but if the resin is dissolved in potash and mixed with the pulp in the beating engine and this alkali afterward treated with alum, it becomes neutralized and washed away, leaving the finely diffused resin throughout the whole mass. It is also used for protecting the coarser manufactured products, such as agricultural implements, against rust by mixing it in a solution with benzine. This is applied as varnish, and the benzine rapidly dries away, leaving a coat which protects the material until it goes to the severe service of actual use.

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Correspondence.

Kansas Glaciers.

To the Editor of the Scientific American:

Geologists have generally agreed that the drift in the greater part of Nebraska and all of Kansas was not carried by glacial ice, as no glacial striæ had been found in these localities. The drift in these places was attributed to floating ice and the action of water currents. In Nemaha County, Kan., are undoubted evidences of glacial action. The striæ are in limestone, and have a course of about S. 24° W. Many bowlders are found here, showing plainly the peculiar markings due to glacial planing.

About twelve miles south of these striæ are many bowlders and other drift material. In digging wells in that vicinity logs, sticks, mussel shells, and black mud have been found at depths varying from 40 to 100 feet. This appears to me to indicate that a forest was buried by the moraine of this glacier.

W. J. McLAUGHLIN.

Polychromatic Photography.

To the Editor of the Scientific American:

M. Vidal, whose article on polychromatic projection you reproduce on p. 72, produces the impression that I carry out the method of Cros and Duhauron. Not only in justice to myself, but also in the interest of scientific progress, it should be understood that such is not the case, and that I have from the first repudiated that principle, which is inconsistent with the established facts which support the modern theory of color vision. It is absolutely impossible that photographs made through any three-color screens should reproduce the natural colors when superposed by projection with white light filtered through the same screens, and yet that is exactly what Cros and Duhauron proposed.

Von Bezold, Rood, Church and other writers of modern text books on color have taken particular pains to point out that the only three colors of light which can be made to reproduce all the color effects in nature are pure spectrum red, green and violet. It is evident, on the other hand, that, while only the pure red, green and violet rays can be used in synthesis, all the rays of the visible spectrum must act to produce the negatives, because all of those rays come from the objects to the eye and excite color vision. Each of my negatives is made by the joint action of various spectrum rays, in proportion to their power to excite the respective fundamental color sensation, as determined by the careful measurements of Maxwell and Abney, and is projected by rays of one color only—the rays which excite that fundamental sensation most exclusively. This principle, the application of which is essential to success, was never recognized by Cros or Duhauron, who both said that one picture should be made through an orange screen and projected through an orange screen, another made through a green screen and projected through a green screen, and another made through a violet screen and projected through a violet screen. References which prove my statement are given in my paper, which is reproduced in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 861, July 2.

M. Vidal also produces the impression that the process is still very complicated and difficult, by ignoring the original devices by which I have reduced it almost to the simplicity of stereoscopic photography. His disposition to unfairness is further illustrated by his failure to credit the original suggestion of composite heliochromy to Henry Collen, of England, four years before either Cros or Duhauron published their first ideas upon the subject. M. Vidal has been sufficiently informed of the facts, but chooses to ignore them, and to write false history. FRED. E. IVES.

2750 N. 11th Street, Philadelphia, Aug. 2, 1892.

A Rock City.

To the Editor of the Scientific American:

A good example of the conditions necessary for the formation of the stone cities occasionally met with exists at Rock City, near Olean, N. Y. This is in a typical outcrop of the Olean conglomerate, which lies at the base of the Pottsville conglomerate. It is composed of layers of loosely cemented white or gray pebbles of prolate spheroidal shape, and ranging from the size of a pea to that of a goose egg, alternating with strata of coarse-grained sandstone.

Both the facts that the Olean rock is very uniform in thickness while the conglomerate proper occurs in varying and irregular beds, and that the sandstone layers are frequently false or current bedded, tend to the conclusion that the formation was deposited in shallow and shifting waters, probably at the edge of the carboniferous sea.

Some six miles south of Olean and 2,340 feet above sea level is Rock City, and at a little distance the cubical blocks of stone some thirty or forty feet high, with their street-like passages at the base, render the name more than excusably appropriate.

As in many similar cases, it has been for years a current popular belief that these rocks were rent asunder into their present condition by some remote earthquake. This theory ought to at once be seen to be incorrect from the remarkably even and unbroken condition of the rock below the conglomerate. Any severe internal convulsions, any force, in fact, acting from within, must have disarranged more than the mere surface rocks; but the regularity of the Bradford oil sand underlying this vicinity shows an unusual freedom from earth-crust movement. It is necessary, then, to refer the whole matter to surface action.

The list of surface forces to which we can reasonably look for a solution of the problem is also limited to physical agents, the rock being of a nature not easily affected by chemical action. First among the physical agents undoubtedly is water. There is no more sure eroding power than flowing water in which sand is held suspended, and for a direct fracture the power of freezing liquid can hardly be overestimated. Given, then, a fault or crevice in the rock made by the shrinkage of the earth's crust, or a mere surface fracture made by the water itself or by floating ice; allow this to become filled year after year with freezing water, and year by year that fracture will be extended. Right here another condition takes a part which, if the rule instead of the exception, would make rock cities much more common. If the rock on which the elements are at work rests on a rough, irregular layer for a base, or is intimately united to it in any way, the result of this freezing process is the breaking off and toppling over of rough, irregular pieces from the corners at the surface. This is the common process. Sometimes, however, as at Olean Rock City, the rock rests on a hard smooth base, between which and the surface rock there is much less tenacity than between the particles of the rock itself. The force of the sheet of ice is forward, and in this case the rock, instead of "cornering" off into irregular fragments, submits to the pressure in the direction of the original crevice and is simply pushed forward on its smoth base.

The fracture once completed, its widening into its present form of streets, varying from four inches to several feet in width, would only be a question of time and the eroding power of the elements. Water would continue to do its work and on a larger scale. The roots of plants and trees, insinuating themselves into little crevices and then expanding with growth, would loosen surprisingly large masses and leave them for the wind to hurl into the ever-widening cañon below. The wind itself, when charged with sand, represents on a large scale the powerful sand blasts so much resorted to artificially in our factories where some eroding power is necessary. While the running water would wear the rock walls smooth and wash the fallen debris from the floor below. So, from this stage the problem is no longer how, but how long?

The texture of the stone at Olean Rock City is coarse and loose, giving to the walls on close inspection a lack of that even, clean-cut appearance so familiar to any one who has ever followed up in the wake of Niagara Falls and studied the smooth, hard lime rock banks; but from a little distance the regularity of the stony channels, the cubical shape of the blocks above ground and the general contour give the place a legitimate and indisputable title to the name of Rock City.

WILDER GRAHAME.

A Noted Inventor, at the Age of 85.

While Mr. Gladstone is by common consent the "Grand Old Man" of English politics, says a correspondent of the New York *Tribune*, there is among his colleagues and supporters another gentleman who might well claim a share in the title.

Mr. Isaac Holden, the oldest and probably the richest member of the House of Commons, as well as physically the smallest, has been a more conspicuous figure in the manufacturing and commercial world than in the realm of politics. He was born in 1807. Like Mr. Gladstone, he is a Scotchman, though for most of his life he has been identified with Yorkshire. His origin was humble, and his early years spent in poverty, as an apprentice to a shawl weaver. For some time thereafter he was a schoolmaster; and it was while serving in that capacity that he bestowed upon the world a great benefit, which was, however, slight benefit to him. This was the invention of the lucifer match, which he came upon unexpectedly while making some chemical experiments for the instruction of his pupils. Other men took up the discovery, and he made nothing out of it.

Next he became a bookkeeper, and while thus employed he made his second great invention, from which he did derive much profit. While working at his ledgers and journals his mind went back to his shawl-weaving apprenticeship, and he became interested in the manufacture of woolen cloth, and sought to construct a machine for carding the wool. For years he studied the problem, making many apparently fruitless experiments. All his savings from his salary were given to the enterprise. The friends to whom he confided his scheme looked with little favor upon it. But his perseverance—and genius—finally triumphed, and he completed and perfected a carding machine which has revolutionized the wool industry of the world. Happily, he secured letters patent upon the invention, and as a result handsome profits soon came to him. He established mills in Yorkshire, literally creating large centers of industry. He also built several mills in France. For many years his income from them has been enormous, averaging probably $1,000,000 a year. Mr. Holden is two years older than Mr. Gladstone, but he acts as though he were much younger. He is as buoyant and energetic as a man of thirty-five.

Perhaps he owes this happy state largely to his habits of life; for his wealth has never led him into luxuriousness. He lives as simply now as he did when he was a poor schoolmaster. Never can he be tempted to eat meat oftener than once a day—at lunch. Breakfast and dinner are made of fruit and some little farinaceous food. In physical exercise he is an ardent believer. Eight miles a day is his "constitutional" walk, rain or shine, hot or cold. No matter how busy he may have been, or how many hours a day he had to work, he always took time for such a walk, as he does now at eighty-five. With good health he keeps a good and kindly temper.

Medical Notes.

Spray for Whooping Cough.—The *Journal de Medecine de Paris* recommends the following prescription for whooping cough:

℞ Carbolic acid (crystallized)..... gr. iii;
Borax,
Bicarbonate of sodium, of each.... ʒi;
Glycerin.
Water, of each..... ʒi. M.
Sig.—This is to be used in a spray from an atomizer.

Powder for Neuralgia.—

℞ Exalgin,
Hydrobromate of quinine, of each.. gr. ii;
Hydrochlorate of morphine..... gr. ¼.
Sig.—Make into one powder, and give two or three a day.

—*Journal de Medecine de Paris.*

Prescription for Laryngismus Stridulus, or Croup.—

℞ Chloroform..... gtt. v or x;
Water..... ʒvii;
Glycerin ..... ʒi. M.
Sig.—A teaspoonful of this every thirty minutes until the patient is relieved.

—*L'Union Médicale.*

A Gargle for Sore Throat.—The following gargle for sore throat is given in *Les Nouveaux Remédes:*

℞ Crystallized carbolic acid..... ʒss;
Absolute alcohol..... ʒii;
Oil of peppermint..... gtt. x. M.
Sig.—Add ten drops of this mixture to a glass of hot water, and gargle with it night and morning.

Huckleberries as a Remedy.—Dr. Winternitz (*Blatter f. klin. Hydrotherapie*) writes of his use of huckleberries in treating leucoplakia buccalis, and other diseases of the mouth, pharyngeal cavity, and tonsils. He treated cases successfully which had existed for weeks and months under other treatment. He uses them chiefly as a gargle, and prefers a concentrated decoction, as follows:

Tinct. vaccinii myrtilli..... fʒxvii;
Coque c. aq. font..... fʒxxxiv;
Usq. ad remanent..... fʒxvii. to fʒxviii;
Express.

For Chapped Hands.—

℞ Menthol..... gr. xx;
Salol..... gr. xxx;
Olive oil..... m. xxx;
Lanolin..... ʒii. M.
Sig.—Make into an ointment and apply twice a day.

Under this treatment the pain will disappear, the skin will soften, and the cracks in the skin will heal.—*L'Union Médicale; Therapeutic Gazette.*

Freezing of Textiles.

A current idea among bleachers and calico printers is that freezing has a tendering effect upon cloth, and most of them take care during the winter season to avoid this risk. However, a short communication of Mr. C. F. S. Rothwell, F.C.S., to the Society of Chemical Industry goes a long way to explode this old fashioned belief, by the evidence of precise dynametric tests on the strength of cotton both before and after freezing. Pieces of cloth were dipped in water and allowed to freeze by an exposure to the air even at a temperature of 3° below the freezing point. The ice which was first formed evaporated away; on testing the cloth the strength was then found to be the same as before freezing. These experiments were repeated on the same piece of cloth four times in succession without any appreciable influence on the breaking strength of the cotton. These results were found to be quite independent of the quality of the cloth. Probably the old idea of the tendering of cloth by freezing arises from the fact that actually frozen cloth will snap and break; this is due to the fact that the fibers are stiff and cannot bend readily. The same thing is brought about by stiffening well up with gum or some similar body, when the fiber becomes tender. Take away the frost in the one case or the stiffener in the other, and the fibers are found to be just as strong as they were before.

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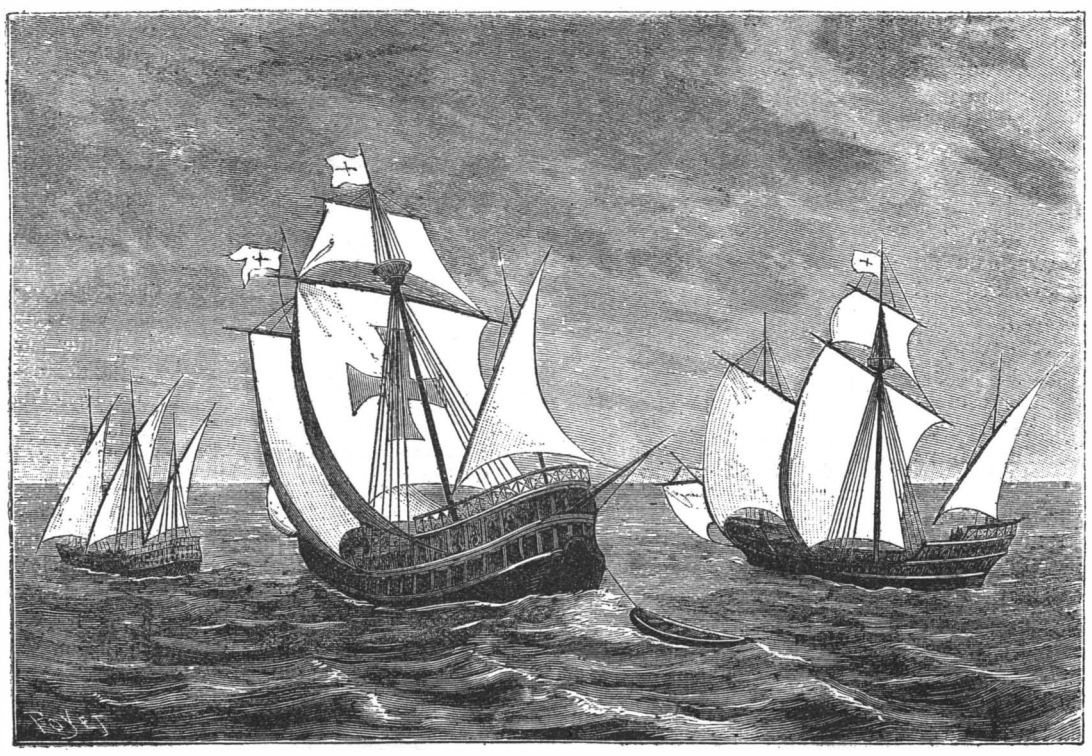
CHRISTOPHER COLUMBUS.

(*Continued from first page.*)

was such that for a long time it was difficult to get a third vessel for that purpose, and at length the King and Queen ordered that one called the Pinta, belonging at Palos, should be seized by force. Even this did not advance matters much, as there was a need of crews, but at last Martin Alonzo Pinzon, a sea captain and an influential man of Palos, offered his services to Columbus, and this proved the turning point in the preparations. When the three vessels were ready, Columbus hoisted his flag on the largest, the Gallego, having a deck with forecastle and cabin, and changed its name to the Santa Maria. The Pinta and Nina had only a small bridge fore and aft. The Santa Maria carried sixty-six persons, mostly from Seville or the province of Huelva, with two Genoese, one Englishman, one Irishman, two Portuguese, and one Majorcan. Palos itself did not furnish any men for this ship, but it and its neighborhood supplied all the officers and men for the Pinta and Nina. The former had a company of about thirty men, under Pinzon, and the latter a crew of twenty-four, under his brother, Vincente Yanez Pinzon. Palos, though a small port, furnished many hardy navigators to Spain's mercantile marine, but for a time the prospect of a quest so daring, under a captain till recently unknown to them, had naturally excited apprehension. Still, the support actually given to the illustrious voyager has immortalized the little town.

The squadron of Columbus, as pictured by Rafael Manleon, a marine painter, is shown in the accompanying view. The suit of sails of the Santa Maria was that of a small three-masted vessel, with five sails only: a jib, foresail, mainsail, topsail, and a lateen. The mainmast was provided with a top, which the sketch represents as round and basket-shaped, and which was capable of affording shelter to firers of grenades. The general form of the hull was that of the round ships of the period. There was a large poop and a small forecastle. The freeboard was very low amidships, and the deck was here open. The pinnace could not be taken aboard, so Mr. Manleon has represented it in tow of the ship under sail.

The nautical qualities of the Santa Maria were excellent, as the admiral's log proves: "This ship behaved very well in bad weather, and had the speed of a good sailer." The same was the case with the two other ships, and the log often mentions a speed of 15 Italian miles an hour, equivalent to 11 nautical miles—a very good speed for vessels sailing as consorts.



THE SQUADRON OF COLUMBUS—THE SANTA MARIA, NINA, AND PINTA.

The Nina resembled the Santa Maria. The Pinta carried lateen sails on her three masts, at least at the beginning of the voyage; but the admiral's log tells us that at the first stop (at the Canaries) this set of sails was replaced by square ones, in order that the ship might be placed in the same conditions as the two others.

These three ships, sailing as consorts, flew the flag of Castile at the mainmast and that of the admiral at the mizzen. The first was divided into four squares, two red and two white. The latter each bore a lion and the others a castle. These were the arms of Castile. Those of Aragon were excluded by the orders of Queen Isabella, the government of that country having refused to participate in the expenses of the expedition. The admiral's flag was a white pennant with a green cross between two crowned letters F and I—the initials of the names of Ferdinand and Isabella, who had given these arms to Columbus. A cross was painted on the sails of the ships, according to the custom adopted by the Spanish and Portuguese, in order to distinguish their vessels from those of the infidels.

Treatment of the Czar's Consumptive Son.

The Grand Duke George, the Czar's second son, who, ever since his enforced return, through illness, from his Indian tour, has been under medical treatment for pulmonary disease, has been passing the winter at Abbas-Tuman in the Caucasus. A private letter from that place states that his imperial highness is undergoing a most remarkable course of treatment. The walls in his apartments are bare and unpapered, the furniture is of plain wood or cane, without upholstering or stuff covering of any kind, and his bed consists only of the thinnest of mattresses. Throughout the winter only a very moderate fire has been kept up, while the windows of the grand duke's rooms have been continuously open. His attendants have suffered dreadfully from the cold; but his medical advisers hold that this low temperature is very beneficial to their imperial patient, as it tends to destroy the bacillus and prevent the formation of tubercle. They maintain that the progress of the disease has been arrested, and express hopes that, if the treatment which they prescribe is persevered with, the grand duke will in two years' time have completely recovered.—*Medical Record.*

A Series of Mistakes in a Boiler Room.

It is a wonder that more serious accidents do not occur when boys and inexperienced persons are set to repairing steam boilers, or superintending their operation. The *Locomotive* tells the following story, and the editor vouches for its accuracy:

A short time ago our attention was called to some most remarkable doings in a boiler room, which we proceed to relate. The boiler was originally built to furnish power, and was good for about 75 pounds steam pressure; but it is now used only for heating purposes. Some of the steam and return valves to the large coils leaked about the stems, and the owner of the boiler, instead of sending for a steam fitter to repack them, called in a plumber. The plumber, being busy, sent his boy helper. The boy began work on some of the valves that were within sight of the boiler front, but being troubled by the steam that escaped, he shut off the steam valves, leaving the return valves open. The coils were large, and when the steam in them had condensed, water began to back up from the boiler, for there was no check valve on the returns. As the boy worked away he noticed that the water in the gauge glass was going down somewhat rapidly and also that the steam pressure was rising. He did not know where the water was going to, nor did he know how to feed it more; but he thought that if he opened the furnace door and so checked the fires, the evaporation and the rise of pressure would proceed much more slowly. Jumping down into the pit in front of the boiler, he opened what he thought, in the darkness, were the fire doors, but it appeared subsequently that he did open the ash pit doors, this making matters worse instead of better. The fire brightened up, and the pressure began to rise rapidly, and the water level to go down. The boy was greatly troubled at this, and when the rubber diaphragm in the damper regulator burst from the increasing pressure, he "went all to pieces," as the saying is, and ran for his boss. The boiler being originally intended for furnishing power, the safety valve could not be set to blow at less than at about 20 pounds, while the damper regulator was designed to carry not more than six or seven pounds, so that its diaphragm burst, naturally enough, before the blowing-off point of the safety valve was reached. The plumber came in haste and found the people in the building overhead badly frightened, and the boiler room filled with steam, so that he could not make out precisely what had happened. He told the boy how to turn on the feed, however, and that well-meaning but badly "rattled" individual went to the back end of the setting, and, instead of opening the plug cock in the feed pipe, he opened the plug cock in the blow-off pipe, which only added to the noise and confusion. Meanwhile, the plumber hauled the fire out on to some pine boards that the regular attendant had laid in the damp pit. The boards took fire and smoke was soon added to the escaping steam, to the intense horror of the occupants of the building, who by this time were on the other side of the street. When the fire had been hauled and the danger averted, the plumber soon learned the cause of the disturbance, and quiet was speedily restored by shutting off the damper regulator and the blow-off, and throwing a few buckets of water on the burning boards.

It seems hardly possible that such a succession of mistakes could follow one after another in so orderly a manner, but we can testify, from personal observation, that they did. And we may add that not long afterward, when the boiler was out of use, a coal dealer put 100 tons or so of coal into the same boiler room, piling it up in such a manner that some of it ran down into the open manhole, and the rest of it covered up the blow-off pipe and the rear door of the setting, which were both open, so that there was plenty of trouble digging them out before the boiler could be started again.

Notes for Painters.

The campaign banner and transparency will soon bring plenty of work to the sign painter. Let us hope, however, that the efforts of these worthy gentlemen will be more successful than they sometimes are. In these days, when solar print photographs are so easily obtained of any given dimensions from a small picture, there seems to be no excuse for the impossible portraits we sometimes see. One of these solar prints can be readily used as a stencil for duplicating a picture any number of times, by means of pounce. Or if but one banner is wanted, the muslin can be laid down on a drawing board, with a sheet of carbon impression paper, face downward, on top of it. The solar print, which should be made on thin paper, should be placed on top of all, face upward, and secured by thumb tacks. With a hard agate point the lines of the face can then be carefully traced, when they will appear on the muslin or canvas below. The print, of course, can be used as a guide for the shading, in finishing the work. Of course, in this method of transferring a design, it is necessary that the material to which the pattern is to be transferred must be laid on a hard background.

In making a sketch for an ornamental design, a rapid method of duplicating the second half of a symmetrical pattern is often wanted. I have found it very convenient to make my sketch on a sheet of smooth, hard-surfaced writing paper, first folding it lengthwise, and after opening it, making the drawing on the inside, the creased line being used for the center line of the figure. A soft lead pencil should be used—not harder than a number two. When the half ornament is drawn, the paper should then be folded again, laid upon a hard surface with the penciled half upward, and rubbed rapidly with the thumb nail, using considerable pressure. On opening the sheet again, the complete pattern will be found. This is an extremely rapid method, and I have found it a great help, as it enables me to judge of the finished effect of a symmetrical design without taking the time to use tracing paper for reversing the half already drawn.—*Painting and Decorating.*

Congress of German Naturalists and Physicians.

Its meeting, the 65th, will this year take place at Nurnberg, from the 12th to 16th of September. The congress differs in several important respects from its daughter the British Association. It includes not merely "natur-forscher," *i. e.*, men engaged in scientific persuits, but physicians, who of course are, or ought to be, men of science.

The number of sections is thirty-two: 1. Mathematics and astronomy. 2. Physics. 3. Chemistry. 4. Botany. 5. Zoology. 6. Entomology. 7. Mineralogy and geology. 8. Ethnology and anthropology. 9. Anatomy. 10. Physiology. 11. General pathology, pathological anatomy. 12. Pharmacology. 13. Pharmacy and pharmacognosis. 14. Internal medicine. 15 Surgery. 16. Obstetrics and gynæcology. 17. Pædiatry. 18. Neurology and psychiatry. 19. Ophthalmology. 20. Otriatics. 21. Laryngology and rhinology. 22. Dermatology and syphilis. 23. Hygiene and medicinal policy. 24. Forensic medicine. 25. Medical geography, climatology, hygiene of the tropics. 26. Military sanitation. 27. Dentistry. 28. Veterinary medicine. 29. Agricultural chemistry and agricultural experimentations. 30. Instruction in mathematics and natural science. 31. Geography. 32. The knowledge of instruments.

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NEW GOVERNMENT LIGHTSHIPS.

The magnitude of the ship-building interests on the great lakes of our northern frontier, and the very substantial growth in this industry during the past four or five years, are now impressing themselves upon the attention of the ship builders and commercial men of the Atlantic coast in a most practical manner, and in ways not heretofore deemed possible. The ship builders on the lakes are not confining themselves to the construction of craft for inland navigation, but are now active competitors for the building of many kinds of vessels required by the coastwise trade as well as for international traffic. The Cornfield Point Lightship No. 51, shown herewith, is one of four similar United States vessels contracted for at the ship yard of F. W. Wheeler & Co., West Bay City, Michigan. She had her trial trip on Saginaw Bay July 2, after which she left for New York by the way of the Welland Canal and the St. Lawrence River, to receive her final fitting out at the Lighthouse Department docks on Staten Island.

Mr. Walfrid Sylven, Chief Engineer Superintendent of the Lighthouse Board, was the designer of these vessels. Another new steamer for the lighthouse service on the Maine coast has likewise been recently turned out from a Cleveland ship yard, and has arrived at Portland.

The four lightships first referred to, officially known as Nos. 51, 52, 53, and 54, were ordered built under act of Congress making appropriation under the Sundry Civil bill approved August 13, 1890, and the contract was let to Messrs. Wheeler & Co. as lowest bidders July 13, 1891; the price being $214,000 for the four. In many respects the vessels are purely experimental, being among the first iron lightships built by the government, and embodying the latest ideas in American ship construction, both in the matter of design and equipment.

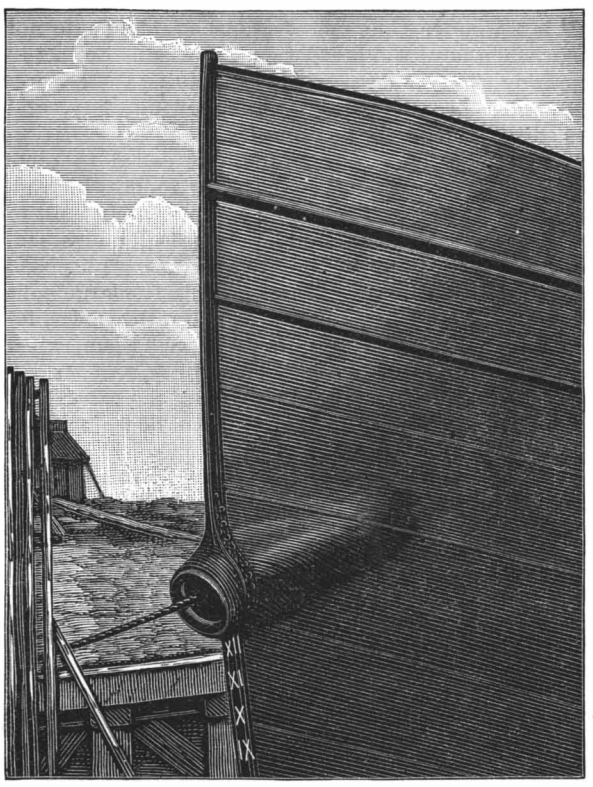
"No. 51" is noteworthy, not only as the first lightship for ocean service ever built on the lakes, but is probably the finest equipped vessel of her kind afloat. As they are similar in design, a description of "No. 51" will suffice for all. Principal dimensions: Length over all, 118 feet 10 inches; beam moulded, 26 feet 6 inches; depth of hold, 14 feet 6 inches; draught of water, level keel, without stores, 8 feet; displacement, 350 tons; sustained sea speed, 9 miles per hour.

The material used is the best American iron, tested to an absolute mean breaking strain of 48,000 pounds per square inch. Plates amidships are 30 inches wide by 8-16 inch thick; at ends, 7-16 inch. A bilge keel extends along each side of the hull for a distance of 55 feet. The hold is divided transversely into five watertight compartments, by bulkheads extending to the main deck.

A new feature is the hawse pipe, shown in one of the views, for the anchor chain, which projects downward through the center of the stem at an angle of 45°, thus giving great freedom of motion and reducing the strain on the vessel. The anchors are operated by a No. 6 steam windlass, built by the American Ship Windlass Company, of Providence, R. I. Steam for the windlass is supplied by a donkey boiler. Elastic chain stoppers prevent the chain from jerking while the anchors are being lowered or in position. As the chain is taken inboard by the windlass, it slides down through a 12 inch cast iron pipe into the chain lockers on the lower deck. Three anchors are used: a mushroom anchor, weighing 5,000 pounds; a bower anchor, 2,500 pounds; and a harbor anchor, 2,000 pounds. Two hundred and fifty fathoms of two inch stud link chain are required to operate them.

The propelling power is a unique feature of these ships, as they are the first light vessels ever built here provided with engines for use in case it is necessary to weigh anchor and put to sea during a storm. Heretofore, when the weather became too rough for the ship to remain at her station, she was obliged to drop her anchors from a buoy and put to sea under sail. When her absence was reported a tug had to be sent out in search for her, and tow her into port, where she was obliged to remain until her cast-off anchors could be located, and she could be once more taken to her station. The Lighthouse Board, recognizing the inefficiency of this method, decided to provide these vessels with engines of sufficient power to enable them, when necessary, to weigh anchor and steam out to sea, returning to their stations without aid. The machinery adopted consists of a cast iron screw propeller, 6 feet in diameter, driven by a fore-and-aft compound engine, 14 inch by 24 inch cylinder, by 16 inch stroke, constructed at the machine shops of Wheeler & Co.

Steam is furnished by two cylindrical single-ended



GOVERNMENT LIGHTSHIP—HAWSE PIPE AT STEM.

boilers of return-tubular form, 8 feet diameter by 9 feet long, each containing 96 3-inch tubes 6 feet 7 inches long, and provided with a Keiller circulator. They are fed by a duplex pump from either sea or tanks. In each boiler is a 36 inch Fox patent corrugated furnace.

On the "No. 51," two 16 inch masts, 67 feet long, carry the signal lights, day marks, and sails. The other vessels have special trysail masts. The steering wheel is located on the forecastle, just aft of the foremast. The interior accommodations are of the best. Steam is used throughout for heating. There are four officers' state rooms and crew space for fourteen men. All interiors are finished in a plain and substantial manner. The cook's galley in the forward end of the deck house is furnished with everything essential to the comfort of the men.

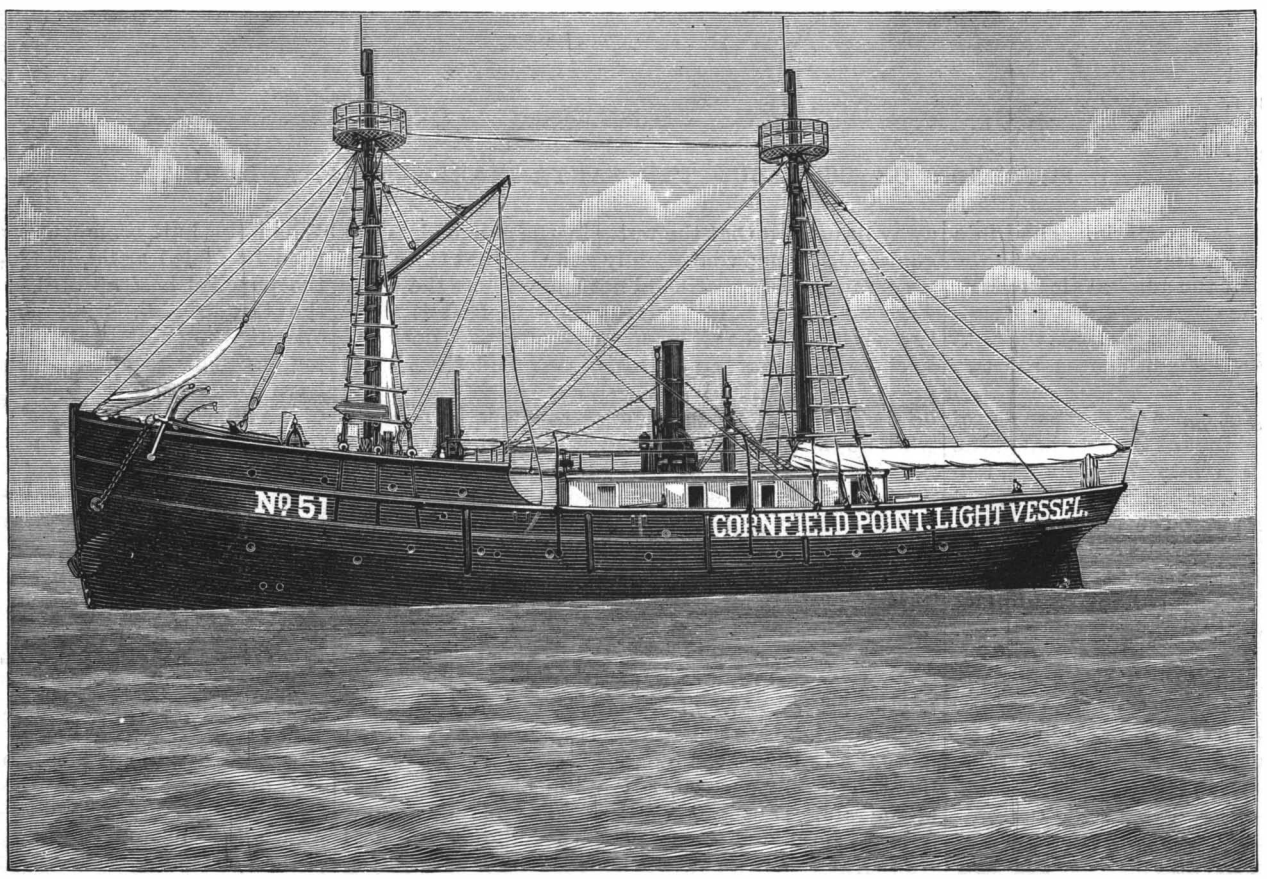
A system of bell pulls and speaking tubes affords communication with all parts of the vessel, and a complete fire-extinguishing plant, by which all parts of the vessel can be reached by a 2½ inch stream in ten seconds, is in constant readiness for an emergency. Fresh water is stored in six wrought iron tanks located in the hold, having a total capacity of 4,500 gallons. Sea water is distilled by a Baird No. 3 evaporator and a No. 3 condenser, aerator and filter provided with circulator pumps, etc., and having a capacity of 2,500 gallons per day.

The electric plant, which is situated in the after part of the main deck house, was built in New York, under the superintendency of Major D. P. Heap, U. S. Corps of Engineers. It consists of two horizontal high speed engines, developing 8 horse power with 70 pounds of steam, from which power is transmitted by two Evans friction cones to two compound-wound Thomson-Houston dynamos, 60 amperes capacity, having an electro-motive force of 110 volts and a commercial efficiency of 80 per cent, supplying electricity to 8 100-candle power and 20 16-candle power lamps, the former lighting the two signal lanterns situated on the masts, 49 feet above the deck, and the latter distributed about the vessel.

This is purely an experiment, being the first attempt at lighting the signal lanterns of a lightship by electricity; yet such precautions have been taken to guard against mishap that failure is deemed impossible. The dynamos, either of which is capable of lighting the whole vessel, are automatically regulated, so that three-fourths of the lamps may be extinguished without change of speed. In case one of the dynamos becomes disabled the engineer can, by simply opening a valve and pressing a button, throw the other into instant action. The signal flashes are regulated by an automatic make-and-break apparatus in the engine room, and can be adjusted to give any desired combination of signals. The double system of wiring is employed for all connections.

The fog bell, weighing 1,000 pounds, is situated on the forecastle. It is operated by a hand lever. The fog whistle, 12 inches in diameter, is worked by a machine consisting of a horizontal non-condensing engine 5 inches in diameter by 6 inches stroke, which through a worm gear turns a cam wheel 20 inches in diameter. The cams work against a small roller in the middle of a lever, one end of which is attached to the balanced whistle valve, the distance between the cams determining the interval between blasts. On a calm day this whistle can be heard fifteen miles.

Many of the improvements are due to Commander George W. Coffin, U.S.N., Naval Secretary of the Lighthouse Board. We are indebted to Mr. Sylven and to the officers and engineer corps of Wheeler & Co. for information given.



A NEW STYLE OF GOVERNMENT LIGHTSHIPS.

Locusts in Morocco.

The British consul at Mogador mentions, in his last report, that while on an excursion inland, about a day's journey from Mogador, he met flights of locusts. He says it was an astonishing and interesting though painful sight, the air being in some parts so thick with them that they formed a dense living brown fog, through which he could hardly find his way, while they so completely covered the ground that the utmost caution was necessary in walking, as he could not tell whether he was treading on soft sand, hard slippery rock or what. Many birds feasted on the insects, including large flights of gulls from the sea, and beasts evidently enjoy their share, for in the middle of the densest swarm he saw a fine red fox dancing about in the most frantic manner, leaping up and snapping dozens of the locusts in the air, until, seeing the stranger, he suddenly dropped on all fours, and quickly vanished in the live fog. Not only did the barbel get their share of the novel food (the consul used the locusts successfully as bait for them), but some of the fish of the Atlantic were found gorged with locusts which had been blown off the land by easterly winds. As usual, they were extensively eaten by the native population, both Mahometan and Jewish.

HOW TO REMOVE IRON RUST FROM LINEN.—If the ground be white, oxalic acid, employed in the form of a concentrated aqueous solution, will effectually remove fresh iron stains.

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BUSHMEN KILLING A LION.

BY PARKER GILLMORE ("UBIQUE").

As there are different races of Bushmen, and they most materially alter in appearance and modes of life, it is desirable to point out that the two men who form a prominent feature of this sketch are of a breed of aborigines that at one time were numerous in parts of the "old Colony," but now are only to be found in Namaqua or Damaraland, and along the margin of the Kalihari Desert. In stature they are veritable pygmies, live in caves, and almost go entirely without clothing when in pursuit of game.

They are wonderfully expert and fearless hunters, while their dogged patience and resolution, combined with power to endure fatigue and hardship, are truly marvelous.

Although guns are being gradually introduced among these dwarf specimens of the human family, yet the majority of them still prefer to use the primitive weapons of their ancestors, viz., bows with poisoned arrows, short throwing assegais, with knobkeeries.

How they accomplish the death of a troublesome lion—an aged brute that has taken to man eating—I will do my best to describe. However, I should state that as long as the lion behaves himself—that is, confines himself to killing game—he is treated with respect, for the reason the monarch of the desert then provides the bush people with many a meal of flesh which they would not otherwise obtain. An aged animal driven off from his troop is almost invariably the offender, and his presence in the vicinity of the residence of a family of Bushmen is soon known by the disappearance of stray goats and occasional pickaninnies. These depredations result in the death of the marauder being resolved on, and the following is the means adopted to accomplish it.

Soon after sunrise vultures are observed circling round some spot in the desert. This is an unfailing indication of the presence of carrion. Two of the most skilled hunters go in search of the carcass, which generally turns out to be that of a quaha* or wilde-beest. From this "find" the hunt actually commences.

Let us examine these copper-colored dwarfs who are about to undertake a task which many a brave man would be excused for shrinking from, especially when it is explained that one alone carries weapons—a tiny bow and arrow—the other being provided with nothing more than his skin kaross—a sleeping covering made out of the skins of small quadrupeds, and about the size of a railway rug.

At first the work of these two plucky little fellows is easy enough, for the spoor is generally distinct, and well they know that their prey will not "lie up" till it has drunk. In time a vley or pool is reached, by its side the herbage has been pressed down and broken, for at this spot the mammoth cat has stretched at length and drunk to his heart's content. Now commences more serious work, for it is impossible to tell how close the lion is to them, and only up wind can the dangerous brute be approached close enough to afford any prospect of success. The spooring here becomes slow, in single file it is conducted, and momentarily a halt is called to listen for heavy breathing, or to sniff if the air be tainted. By this time we will imagine that the sun has gained meridian altitude, the hour when the carnivora sleep soundest after a heavy meal.

The advance of the two sons of the desert is a wonderful performance, it is the perfection of stalking, not even one of the cat tribe could surpass them. At length the Bushmen's patience is rewarded, they have heard, smelt, or seen the lion, and learned all details of the position he lies in. So ranging themselves side by side, both exert their greatest ingenuity to get close to the foe without being detected. Their object is soon attained. With a jerk the kaross is thrown over the sleeping marauder's head, and a moment afterward a poisoned arrow is driven into his flank. Thus unceremoniously awakened, he stops not to learn who are his disturbers, but bounds off into the veldt with but one object in view, viz., escape. Two or three hours afterward the desert re-echoes the stricken beast's roars of pain, and ere the sun has set the grand old beast has died.—*Graphic.*

AFRICAN BUSHMEN "STALKING" A LION.

BUSHMEN KILLING THE LION.

* Generally erroneously pronounced "quagga."

Azurite Crystallizations.

Mr. B. S. Yeates described a few years since some interesting crystals obtained from Grant County, New Mexico. They had the same crystalline form as azurite, and occurred in masses varying from 1 oz. to 70 lb. Although they had the appearance of native copper, they were found to consist of particles of a clay intimately mixed with atoms of native copper. Mr. Charles H. Snow has now obtained some specimens of the same crystals from the Copper Glance and Potosi mine, New Mexico, and offers an explanation of their occurrence. It seems probable that a solution containing copper, which was probably derived from an eruptive dike contiguous to the copper vein, primarily occupied the vein space, together with the clay, which the solution assisted in rendering soft and plastic. The copper appears next to have been gathered or deposited throughout the clay as azurite; and then, through some agency, such as gases from below, the water and carbonic acid of the azurite were expelled, leaving lumps of porous native copper which retained the form of azurite. The still soft clay was now pressed into the native copper sponge, which acquired thereby the compact appearance, but not the weight, of metallic copper, while retaining the form of the azurite crystals.

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The Bamboo in China.

In looking at a Chinaman's house we have no difficulty in at once assigning to the influence of factor No. 1 about three parts of the resultant structure. To apportion the other part between factors 2 and 3 takes more time, and may lead, if we are so disposed, to a lifetime's study of history, language, and social custom.

The great natural material everywhere ready to hand in China is the bamboo (*Bambusa arundinacea*). This plant grows freely everywhere, and more readily than our "quick hedge" at home. while it is infinitely more adaptable to being fashioned into structures of all kinds.

The first thing a farmer does in China is to plant round three sides at least of the site of his house and steading a bamboo fence or grove, the second to cut it gradually down, and therefrom make every conceivable thing he may want, from his house itself down to his fan, opium pipe, and chopsticks.

The bamboo can be cut from the size of the top joint of a fishing rod to a straight, tapering mast, 4 inches or 5 inches in diameter and 40 feet long. It is a hollow-jointed tube, as nearly round as possible, hard, strong, very light; and lest, when used as a strut, it should give way by buckling, is braced through at intervals in the most approved manner by its joints.

In China, nature has lent herself to the toleration of ignorance or of unprogressive knowledge, and has provided on every man's land a ready-designed compression member of the best form, and a beam of nearly the best. Beginning with the house, where the plan initially is an oblong divided into three, a reception and dining room in middle, with the Lares and Penates (actual ones of wood or bronze, representing Buddhist or Taoist deities) conspicuously placed, and two bed rooms, one on either side of the reception room. The walls and partitions are of upright posts of the larger diameter bamboo, to which are lashed with bamboo strips smaller horizontals of bamboo. Through these are intertwined still smaller bamboos, or laths of riven bamboo plastered over with clayey mud. The door is of interlaced split bamboo, with bamboo hinges. The roof is always a purlin roof. Here comes in our "knowledge of principals" clause. The "king post truss," with the general principle (or principal!) of framed structures, is unknown to the Chinese, and the pieces, therefore, must all be in transverse strain. Large bamboo purlins are placed longitudinally from one partition to another; rafters of smaller bamboos are lashed to these, and still smaller are overlaid longitudinally again. On these a thatch of broad leaves is laid, and the roof—the lightest, probably, constructed anywhere—is finished.

The floors are generally of earth, punned hard, sometimes overlaid with "chunam," a kind of native concrete. This finishes a house, if not warm in winter, at least cool in summer—which latter is more important in Southern China and in a country where, in cold weather, every one carries his own private store of burning charcoal about with him in the house.

Now as to furniture. The first essentials are a bed to rest (and smoke opium) on, a table to eat off, and a few chairs. These are all made, to the last ounce or cubic eighth of an inch, of bamboo. The surface of the table is a panel of bamboo clove laths split from the stems of larger diameter, laid side by side, polished side up, and framed in between whole bamboos or one whole bamboo, bent round at each corner of the table by cutting out a V-nick nearly through, and bending the cane until the mitered edges meet. This frame and panel rests on bamboo legs, with rails of smaller diameter. The bed is a flat plane of split bamboo again interlaced, resting near its ends on trestles of the same universal material. The trestle is formed by cutting out a notch in the center of each piece forming the A's of the trestle, of such a shape that when bent around another piece—the longitudinal of the trestle—it just embraces it, and supports it in the angle at the top of the A. These spring beds of a patent now expired, say 1,900 years, are by no means to be despised, and the writer has, when hard pressed for quarters, or when in advance of his rear guard, got a good night's rest out of them with a rug or coat only between himself and the laths. Certainly they are far in advance of the iron bedstead of "modern civilization," which has carried away below decks and leaves holes or spikes to trap or impale the weary traveler—an institution dear to the British landlady, which some of our readers may have encountered.

The inevitable mosquito curtain is slung on four bamboos over the bed, and, proving inefficient, a bamboo fan is used to ward off these direct emissaries of the devil.

To make a fan, a piece of three-eighths inch diameter bamboo, two joints in length, is taken and cut off below the two alternate joints. The upper half is then split down as far as the joint into say 21 or 28 thin spikes (a multiple of 7 is usual for "good joss"). These are spread out through 180° at equal distances apart, and a piece of string threaded through keeps them in place. A piece of paper is then pasted on both sides of these, and the whole trimmed off to the desired shape, and edged with paper of another color. The fan is then ready for use by male and female alike, chiefly the former. Umbrellas are made much in the same way of the same material, and their construction is a marvel of ingenuity and patience.

We have adopted the umbrella from the Chinese (wasn't it Jonas Hanway, the City merchant, who was so wonderfully eccentric or marvelously plucky as to introduce them?), and the time may come—as it has come for a day at a time in the City—when every one will be allowed to cool their faces, and so sympathetically the whole surface of their bodies, by the same means, instead of cooling their interiors only by iced decoctions.

For irrigation, at which the Chinese are adepts, the bamboo is invaluable. By cutting a bamboo in halves down the middle, or by cutting a notch over each joint, and there through extracting the joint, an excellent water supply pipe is made. Water wheels also, up to 16 feet diameter, are made, with the exception of the axle, entirely of bamboo, and are of most clever construction. These are used for lifting water for the irrigation of rice fields. The buckets for lifting the water are themselves joints of bamboo of large diameter—one end closed by the joint, the other open. These, working night and day, supply large areas with water, and show the value of roping in a natural force for one's own purposes, which will work on while one is asleep.

The universal tobacco pipe of the poorer Chinese is a bamboo root and stem, about 18 inches long. The root is hollowed out for the "fill," a hot wire being put through the joints; a bit of goosequill or jade makes a mouthpiece.

Fences, short bridges, money boxes, walking sticks, "swizzle" sticks, sedan chairs, torches, baskets, fish traps, hats, brushes, measures, kites, and scores of other things are all made entirely from bamboo. Bamboo shoots are eaten as a vegetable, and "bamboo chow-chow" is pigeon-English for corporal punishment.

Assaying a Gold Brick.

About 9 o'clock in the morning two men entered the Mitchell building, on Third Street, St. Louis, and, getting into the elevator, mounted to the sixth floor, and went straight to the rooms of the United States Assay Office. One of them carried in his hands a bundle the size of a thin brick, wrapped in paper. He laid it down on the counter in the office and slowly unwrapped the bundle. It was a gold brick. The clerk took the bullion, and, stepping across the floor, placed it in one of the pans of a large pair of scales. Then he closed the office windows and placed some weights in the other. When it balanced nicely he went to his desk, took out a blank form, and wrote to the effect that 400 ounces of gold bullion had been received from the St. Louis Smelting and Refining Works, at the United States Assay Office, to be assayed. This was signed by E. C. Jewett, the assayer in charge, and the men went away. This is the first step the government takes toward obtaining precious metal for coining purposes.

It is extremely interesting to follow this process of assaying through all the steps until the value of the gold is determined and the government's check given for it. Through the kindness of Assayer Jewett, a *Republic* reporter was allowed to witness it.

While Clerk Rex was filling out the receipt Mr. Jewett explained the marvelous delicacy of the scales. Their weighing capacity is 5,000 ounces, and it is possible to indicate by them a difference in weight of one gramme. To illustrate so that this may be easily grasped, two heavy men could be placed in one of the pans, and by removing a pin from the coat of one of them the balance would be changed. Still, it would be difficult to obtain the exact weight of the men, owing to the constant change in men's bodies by perspiration and other causes.

After the bullion's weight was determined on these scales it was taken to the furnace room and placed in a black lead crucible. This was set on a fire brick resting on a grate and a fire built around it. The fuel used is a mixture of anthracite coal and charcoal. After an hour's melting, during which time it was frequently stirred with a plumbago poker, to which gold does not cling, a sample of the metal was dipped out with an ordinary clay pipe and poured into a small mould. The assay is made from this, as it takes so much longer for the larger quantity to cool. A piece of the sample was cut off, pounded, and then rolled through a roller of tool steel, looking something like a clothes wringer, to make it thin. When this was done Herman, the German who aids the assayer in his work, handed the thin golden strip to him, and then went back to the furnace room to pour out the molten thousands into the big mould.

Mr. Jewett cut the strip into small pieces, and then forming little lead cornucopias of uniform weight, dropped into two of them 500 milligrammes (one sixtieth of an ounce) of accurately weighed gold to be assayed. Into two others he put the same quantity of absolutely pure gold. Enough silver was then added to make the proportion of silver to gold 2 to 1, as this proportion is necessary in order that the gold should separate from the silver when boiled in nitric acid.

There is in all gold a certain amount of silver, and it is owing to its presence and certain other foreign substances that the color of gold varies. The idea that gold found in California or Australia is of such a color because found there is a mistaken one.

After the silver had been added the leaden cornucopias were squeezed up and each one placed in what is called a cupel. A cupel is a little cup made of sheep bones burned to ash, ground fine, moistened and moulded into a mould an inch long, an inch in diameter, with a cup-shaped depression at one end. The cupels were placed in a small furnace with a temperature of about 1,100 degrees Centigrade, and when heated to a white heat the little metal chunks were laid by the aid of tongs one in each cupel. They melted, sputtered, and bubbled, and then began to grow smaller. In about ten minutes they were taken out and all the lead and foreign substances had been absorbed by the cupel, leaving only the noble metals in little round balls. When these were boiled in nitric acid the silver passed into nitrate of silver and the gold was left in its pure state. By this was found the ratio of pure gold in the bullion.

The weighings of pure gold are used as a check to any peculiar conditions of heat, etc. The assayer knows the constitution, weight, and specific gravity of the pure gold used. When it is weighed after the heating process, if it has changed weight, it is fair to suppose that it is owing to the conditions of heat or strength of acid, and that the same influences have been at work on the assay gold. By allowing for this in the assay gold a true result is reached.

The next step was to find the weight of the gold and silver together. The lead cornucopias were again filled with certain weights of the pure and assay gold, but no silver added. When melted in the cupels the baser metals disappeared as before, and the gold and silver were left together. By subtracting from the weight of gold and silver the weight of the gold, the exact weight of the silver was obtained. Of course, the proportion is usually very small. If the amount is not sufficient to pay for extracting, the government does not pay for it, and charges nothing for extraction.

The entire amount of gold in the bullion is found by multiplying its weight by the proportion of the gold. This is reduced to standard or coin gold by multiplying this amount by ten and dividing by nine, as standard gold is only 90 per cent fine, and the depositor is paid by the government $18.60 per ounce of standard metal, equal to $20.67 for fine gold. The assay fee is one-eighth of 1 per cent of the total value of fine gold, the melting fee is $1, and the alloy charge about one cent on a hundred dollars, and after this is deducted the assayer hands a check to the owner of the gold. The entire time occupied by this complicated operation was from 9 A. M. until 1 P. M., only four hours.

Eye Strain as a Cause of Nervous Derangements.

Dr. Ambrose Ranney, in the New York *Medical Journal*, draws attention to the view that "eye strain" may be a frequent and extremely important factor in causing many forms of nervous derangements—even in such as are commonly regarded as organic diseases—as, for example, epilepsy, chorea, and insanity. Among the cases reported by Dr. Ranney which were cured by the use of spherical, cylindrical, and prismatic glasses, combined occasionally by tenotomy of certain of the ocular muscles, may be mentioned the following: Four of epilepsy; several of nervous prostration of so severe a form as to justify the most serious doubts of a perfect recovery being possible; one case of mental collapse to an extent which rendered the patient unable to dress himself until told which article of apparel first to put on; one case of melancholia with morbid impulses, the patient walking about the streets touching every tree and lamppost he met; one case of epileptic mania in a patient who required a padded room; several in which confirmed inability to sleep, severe neuralgic paroxysms, constant headache, etc., formed an important feature in the clinical histories; one case of very severe neuralgic paroxysms of the face, which drugs would not control; and other cases of various conditions that were equally distressing and that had withstood all therapeutical measures.—*Lancet.*

Electrical Discharge Peculiarities.

In some experiments by Prof. E. J. Houston with iron filings and bits of fine wire in connection with magnets, the peculiar groupings of the iron wire in chains of polarized particles were clearly shown.

A curious resemblance is possessed by this field and other wire fields to the discharge produced by a lightning flash, or other high potential discharge; such, for example, as the recent 500,000 volt discharge of Elihu Thomson. This resemblance, Prof. Houston says, quite naturally leads to the speculation whether the peculiar forked or curved shapes of such discharges are not due to similar causes, viz., to polarized chains of particles of the medium which offers paths of less resistance to the discharge than the spaces adjoining or surrounding them.

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EXPERIMENTS WITH WATER JETS.

A jet of water thrown into the air seems at first sight to be a very simple affair, and one that would not repay a very close study. In fact, however, the water jet is governed by very complex and important laws, which are as yet not perfectly understood. In particular, the manner in which the solid stream breaks up into separate drops at a greater or less distance from the orifice is of especial interest.

A soap bubble, as is well known, consists of a mass of air inclosed by an envelope of soap and water. This envelope is elastic and in a state of tension—just like the rubber toy balloons. If a small opening is made in the balloon with a pin, the gas escapes and the covering collapses. So if we stop blowing into the soap bubble, and allow it to hang from the pipe, the elastic force of the walls of the bubble will force the air out through the stem, and the bubble will rapidly disappear. If we touch the outside of the bubble in such a way as to break the continuity of the film, the tension is so great that the entire bubble is destroyed, and the film of soap and water is converted into a fine spray.

Now a drop of water has a similar constitution to a soap bubble. The outside surface of the water is in a state of tension, and presses upon the interior with a small, but perfectly definite, force; and to this law of the surface tension of liquids are due some very interesting natural phenomena. The insects which walk on top of the water owe their power to keep afloat to the tension of the film of water at the surface. A needle or a steel pen may be made, with a little care, to float on water in the same way; while the remarkable spontaneous movements of camphor, when placed in clean water, are explained by the same law. It would, however, be necessary to go too deeply into this rather difficult subject to fully discuss it; and it is mentioned here only to show its connection with the experiments about to be described, which can be best understood by considering a jet of water as somewhat resembling an elongated, but solid, soap bubble, with the interior compressed by the tension of the surface film, and with a tendency to break up into separate drops, or bubbles, from the unequal force of this surface tension.

In Fig. 1 is represented a jet of water thrown into the air from a rubber tube furnished with a glass tip, the opening of which has a diameter of about a sixteenth of an inch. The force of the water is adjusted to throw the jet about three feet into the air. Under these conditions, at a little distance from the orifice of the tube the jet will break up into drops of various sizes, which scatter themselves irregularly in the air so as to cover a large surface where they fall. If we now bring a stick of electrified sealing wax near to the jet, its character immediately changes. The jet gathers itself together, and, instead of a scattered spray of irregular drops, it is transformed into a procession of drops, nearly equal in size and distance from each other, which fall with great regularity. The electric excitement appears to so affect the surface tension of the jet of water that its action is exerted more uniformly and regularly. A tuning fork placed on a sounding board and set into vibration near the jet produces a similar effect.

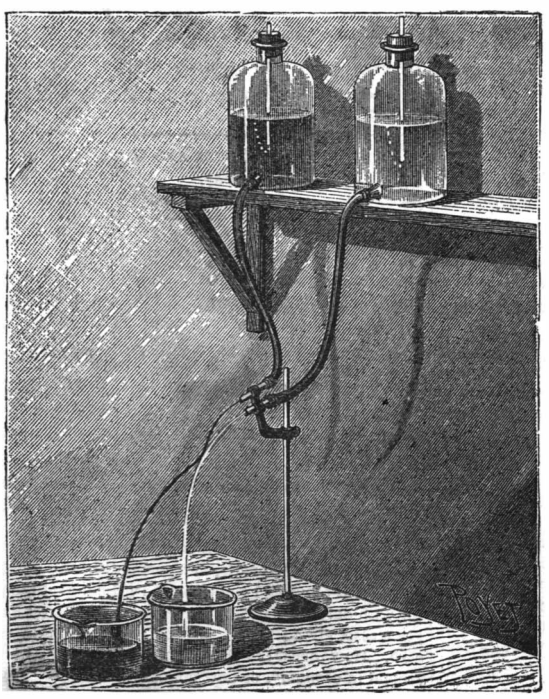

Fig. 2.—TWO WATER JETS WHICH DO NOT MIX.

A practical use is made of this action of electricity in the siphon recorders which receive the telegraphic messages sent over the ocean cables. The message is recorded upon a sheet of paper by means of a fine stream of ink discharged from a small tube, which is moved in different directions by the electric current. The ink in this tube is electrified by a separate apparatus, so that it is thrown on the paper in a fine, regular stream. In this way the tube, or pen, does not have to touch the paper at all, and all friction between paper and pen is avoided.

In Fig. 2 is illustrated an interesting experiment with liquid jets, which shows how, in some respects, they act like solid bodies. Two jets of water, one of which is colored with aniline, are arranged so that they strike each other at an acute angle. Under these circumstances they do not mix at all, but the colored

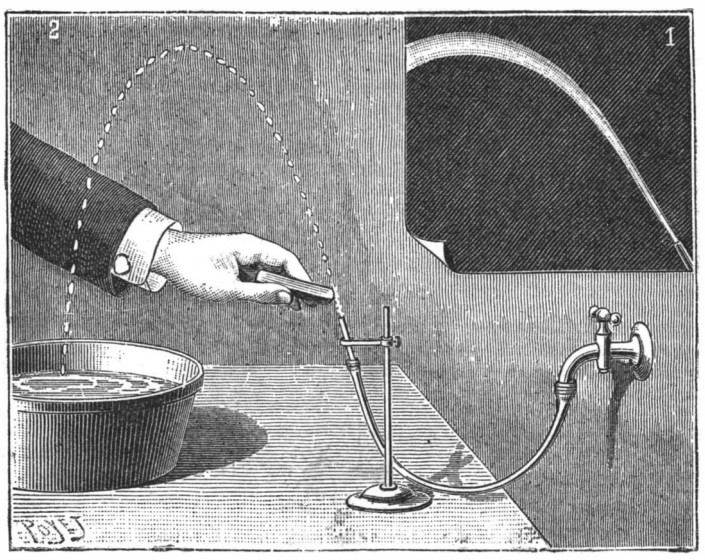

Fig. 1.—A WATER JET CHANGED BY ELECTRICITY.

water rebounds from the colorless stream and follows a perfectly distinct course. But if a piece of electrified sealing wax is brought near the two jets, they unite at once, and both streams mix together and follow an intermediate path to the ground.

The hydraulic microphone of Mr. Chichester Bell (Fig. 3) is another example of the sensitiveness of a liquid jet. If a fine jet of water is forced from a thin glass tube through an opening of about 1-75 of an inch, and allowed to strike the upper end of a glass tube of about half an inch in diameter, over which a piece of thin sheet rubber has been tightly stretched, no effect will at first be noticed; but if a watch be placed close to it, every beat of the escapement will affect the continuity of the jet of water, and each tick of the watch will be magnified and reproduced by the rubber and large tube so that it can be heard over a large room, like the taps on a drum.

In this connection we notice that in a communication to *Nature* (of London), Prof. W. B. Croft says: "A form of this effect lately presented itself which seemed in some ways new. A thin jet, five feet high and arched so as to be three feet at the base, was falling in a feathery spray. At thirteen feet distance a small Wimshurst machine was set going. Not instantly, but after two minutes, the spray gathered itself up almost into one clear line; although the jet was turned up and down and the machine was discharged, the falling water would not resolve itself again into spray for fifteen or twenty minutes. It is a striking illustration to help one to imagine what the electrical forces of the air may do. We can perhaps understand those thick, thundery rain drops that almost allow us to pass between them while they are giving friendly warning of what will come."

The accompanying engravings are reproduced from *La Nature.—Popular Science News.*

Tricks of Hindu Jugglers.

BY T. B. HOLMES.

The wonderful tricks of legerdemain, the feats of balancing, tumbling, and rope dancing performed by men and women in the theaters and circuses in this country are hardly equal to the commonest tricks and feats performed by Hindu jugglers in their native land.

It is a very common sight in India to see young girls balancing themselves on their heads with their heels in the air, or to see them walking on their hands and feet with their bodies bent backward. It is an easy thing for a girl of fifteen years to bend backward, plunge her head into a hole eighteen inches deep, full of water and dirt, and bring up between her lips a ring that was buried in the mud.

Women are not less dextrous than the girls and the men. They are frequently seen dancing in couples on slack ropes, one playing on the *vina* or Hindu guitar, while the other poses, postures, and capers gracefully about with a vessel brimful of water in each hand, without spilling a drop.

A Hindu juggler will stand a pole twenty feet high on the ground, and then climb to the top of it as if it was a firmly rooted tree. He fixes the top of the pole in the middle of his sash and dances about in all directions without disturbing the equilibrium of the pole. The same man, after giving an exhibition of this sort, slides down the pole, takes a boy on his shoulders, climbs once more to the top, fixes the top of the pole in the hollow of his foot, and stands erect, balancing himself, with the boy on his shoulder, as easily as the average person would balance himself on one foot on the ground.

Another very difficult act is that of balancing a sword with a broad blade, the point resting on the performer's chin; then the juggler will balance a straw on his nose, or on a small stick which he holds in his lips. While performing this trick the juggler sometimes places a piece of thin tile on his nose and tosses up a stone which, falling on the tile, breaks it in pieces.

Some of the most wonderful feats of these men are performed on the slack rope. While balancing himself on the rope, the performer carries a long stick on the end of his nose. At the top of the stick is set a large tray, from which walnut shells are suspended by threads. He takes in his lips a stick long enough to reach the shells, and by sudden movements of the lips he tosses each shell upon the tray without deranging anything or losing his balance. While doing this he strings beads upon a horse hair by means of his tongue, and without any assistance from his hands.

The Hindus have found means of communicating their great dexterity to domestic animals. They train bullocks to perform very difficult tasks. A Hindu juggler will lie down on his back and place a small piece of stout wood, 2 feet high and 6 inches in diameter, on the lower part of his stomach. At his command a trained bullock will set its four feet on the top of this stick and balance itself. The juggler will then place another piece of wood, similar to the first, a few inches from it, and the bullock will shift its position to it without touching its feet to the ground. Goats are also taught wonderful feats by this queer people.—*Christian Union.*

New Antiseptics.

Among new antiseptics from coal tar derivatives, says S. A. Walton, may be mentioned pyoktanin, methyl violet, the most antiseptic of the aniline colors. A solution of 1 in 1,000 is used in various eye diseases, phthisis, ulcers, etc. There is a yellow variety commonly known as auramine, also used antiseptically.

Lysol is a saponified phenol derived from cresols, and contains the higher homologues of carbolic acid. It is said to possess higher antimycotic power than carbolic acid, and to be less poisonous. This preparation is much used in Germany at the present time.

Retinol, a distillation product of pine resin, is a viscid fluid hydrocarbon. It is a non-irritating and stable antiseptic.

Europhen, iso-butyl-ortho-cresyl-iodide, contains 23 per cent of iodine, and is non-poisonous.

Dermatol, a basic gallate of bismuth, forms a powerful antiseptic and desiccant.

Sulphaminol, thio-oxydiphenylamine, the antiseptic action of which is due to its decomposition in contact with the fluids of the body into sulphur and phenol.

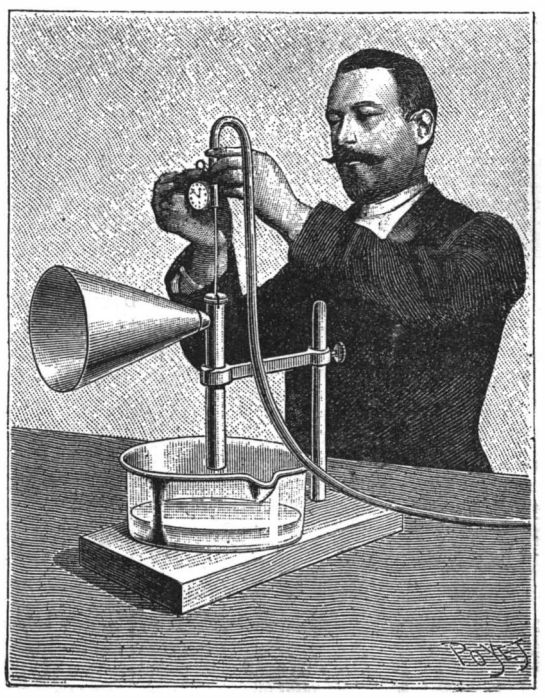

Fig. 3.—BELL'S HYDRAULIC MICROPHONE.

Monochlorphenol is prepared by the action of chlorine on cooled phenol. It is a powerful antiseptic and less irritating than trichlorophenol.

Camphoid, though only a mild antiseptic in itself, is a valuable adjunct to this class of bodies, as it forms a ready method of applying antiseptics to the surface of the skin, and owing to its composition (of spirit, camphor and pyroxylin) it forms a valuable solvent for substances such as salicylic acid, resorcin, hydronaphthol and many others.—*Chem. Tr. Jour.*

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RECENTLY PATENTED INVENTIONS.

Railway Appliances.

METALLIC TIE.—Albert G. Budington, Austin, Texas. This is an inexpensive tie designed to be easily secured in a roadbed, and to which the rails may be readily and solidly fastened, it being also adapted for use in connection with wooden sleepers, being easily placed in position between such sleepers without tearing up the rails. It has movable chairs, with dovetailed recesses in their upper surfaces, with detachable tie bars to be secured to the rails and having recesses registering with the chair recesses, binding keys entering both recesses and clamping the flanges of the rails, with means for fastening the keys in place.

TRACK RAIL ALIGNING DEVICE.—Wallace E. Loughrey and Alonzo H. McGrew, Centreville, South Dakota. This invention consists of a frame in which a lever is mounted to turn and be adjustable, a plate connected with the lever being adapted to engage the rail, the frame in operation being placed transversely of the track near that part of the rail to be drawn into alignment. The device is strong and simple in construction, and adapted to do its work quickly and efficiently.

Mechanical.

ROCK DRILL.—Perley P. Belt, Waco, Texas. This invention provides a simple and efficient rock drill, in which the forward feeding and rotating of the drill are accomplished automatically. A tappet plate is placed loosely on the drill rod, a clutch mechanism connected with the plate engaging the rod, which is impelled by a spring, while a cam with conical ends lifts the tappet plate. The drill rod and drill bit are made tubular to render them self-clearing, air or water being forced through them to eject chips and dust.

SHOEMAKER'S LAST.—John B. Cass, Brooklyn, N. Y. The last stock has on it an instep block, a cap plate being held on the comb of the stock by wings on a socket tube, and pins passing through the stock and wings, while a latch dog pivoted between depending ears and in a slot in the cap plate is adapted to enter a recess in the top of the block, a plate spring secured by one end in a groove of the last stock pressing the heel of the latch dog. The construction forms a novel means of detachably connecting the instep block to the last stock, giving increased durability to the last and rendering it more convenient in use.

Agricultural.

WEED CUTTER.—Grosvenor S. Andrus, Walla Walla, Washington. This is a simple and convenient implement which can be readily managed by one man, one or more blades being carried by the axle. The cutter travels beneath the surface of the ground and cuts the roots of the weeds, the roots being cut without turning over the ground and placing it in condition for other weeds to grow. Means are provided whereby the cutter may be made to travel at greater or less depth beneath the surface, as desired.

FENCE FOR HAY STACKS.—Sven O. Thompson, McPherson, Kansas. This is a collapsible inclosing fence, adjustable in its parts while in complete form, so that its sides may be contracted and expanded to encompass a large or small stack of hay and allow the live stock to feed from it as the hay is consumed and the size of the stack diminished. The structure, when in position encompassing a stack of hay, is simply seated upon the ground whereon it is erected, and permits the free feeding of cattle, horses and sheep from the stack, while preventing waste.

Miscellaneous.

NOZZLE HOLDER.—Arthur Cuthbert, London, England. This is a device to automatically direct a jet of water so that every part of the area within range of the jet will receive an equal amount of water. The holder comprises a frame in an opening in which is a hose coupling, a horizontal revoluble wheel being mounted on the frame and a nozzle-holding deflector pivoted to the wheel, with means for swinging the deflector on its pivot as the wheel is revolved. The construction is such that the parts can be cast so as to require little machinery and fitting, though in this case gun metal would be preferable to iron in making the device, to prevent rusting, or iron may be used and galvanized.

CARTRIDGE RELOADER.—Fremont B. Chesbrough, Emerson, Mich. This is a simple instrument, to be operated by a screw in the same manner as a vise, and by which a shell may be easily loaded and the shell and bullet properly shaped. In one of two oppositely arranged jaws is held a tapering tube, shaped to fit a cartridge, a screw extending transversely through the jaws, and one of the jaws carrying a pivoted nut to receive the screw, a hook pivoted on one of the jaws being adapted to engage the flange of the cartridge.

GAS GENERATOR.—John J. Kirkham, Terre Haute, Ind. This is a generator for the manufacture of fuel and illuminating gas, and for enriching air and natural gas, in which generator oil is exclusively used for heating the generator and supplying the carbonaceous ingredients of the gas. It consists of a series of vertical chambers each containing a body of checker work and each having independent oil injectors and separate air inlets, a central retort or outlet flue opening at its lower end into the lowest chamber and passing out through the top of the generator, while a connected conduit pipe has one branch leading to a hydraulic seal and another branch provided with a valve and a suction apparatus.

CALCULATOR.—Charles H. Clarridge, Libertyville, Iowa. The operative parts of this calculator are preferably made of sheet metal, for economy of construction, the object of the invention being to provide a simple and low cost machine which may be quickly and accurately operated to perform addition, subtraction, multiplication, and division. The machine has numbered keys adapted to operate numbered wheels geared together to turn in opposite directions, automatically carrying the tens, and the construction embraces various novel features whereby the machine may be cheaply built and rapidly operated.

VENDING MACHINE.—Gustavus A. Weller, La Salle, Ill. A wheel in this machine engages the article to be sold, and a sliding spring-pressed bar carries a pawl engaging a ratchet wheel on the former wheel, while a coin-holding lever fulcrumed on the bar has at its front end a spoon to receive the coin, a locking arm pivotally connected with the rear end of the lever engaging the bar to lock it in place. But few parts comprise the apparatus; so it is not liable to easily get out of order, while it is very accurate and automatic in operation, and is more especially designed for selling envelopes, postage stamps, and similar articles.

CHANGE RECEIVER.—Celestin Bergeron, New York City. This is a device for use in ticket offices, cashiers' desks, etc., to enable a person to conveniently and rapidly gather the change. The change table has in its top an opening in which fits a pivoted chute, a spring holding the chute flush with the table, but permitting it to be depressed by a finger piece. The change to be paid out is placed on the pivoted end of the chute, where the receiver can see and count it, when, by pressing on the finger piece, the front end of the chute opens into the palm of the hand.

PRESERVING THE COLOR OF BRICKS.—Jacob D. Graybill, Shreveport, La. A compound for preventing the discoloration of pressed or other finishing bricks, when laid in the walls of buildings, is provided by this invention. The preparation fills the pores of the bricks with an oily mucilaginous substance which, when dry, is hard and waterproof, preserving the brilliunt red color of pressed bricks as when first laid up, there being in the compound a small quantity of Venetian red.

SCAFFOLD BRACKET.—Charles Ragsdale, Purdy, Mo. This is designed to be a cheap and safe bracket for use by builders to support a staging, and one which may be quickly and readily applied to a building and supported from the studding without any outside bracing, while it may be folded compactly when not in use. The bracket is of an essentially triangular form, having horizontal bearer bars, an upright which in use rests against the side of the building, and a brace connecting the outer ends of the bearer bars with notches low down in the upright.

FIELD RANGE.—John Marcee, of the U. S. Army. This is an apparatus especially adapted for the use of troops in the field or for parties camping out, being readily set up and arranged for cooking, while it may be packed in compact form when not in use. The oven comprises a series of pan-like sections sliding one within the other, an extension cover being also formed of sliding sections, while a series of pans is nested within the oven for the cooking of several kinds of food at the same time.

BRIDLE BIT.—Oliver M. Sloat, Brooklyn, N. Y. This is an improvement on a former patented invention of the same inventor, providing an adjustable bit which may be used as an ordinary bit, but which, when the horse begins to pull, will serve as a curb bit, the force of the leverage being increased with the pulling strain applied to the bit. According to the improvement, the check pieces are so constructed that they will project only beneath the mouth bar, while the spring of the rein eyes is so concealed that it will be almost always out of sight, and cannot hurt the horse's mouth.

FEED BAG ATTACHMENT. — Fred S. Kerr, New York City. This is a rope or strap device, provided with a take-up, capable of attachment to any feed bag and any convenient portion of a harness, by the aid of which a horse may feed in a manner similar to feeding in a stall, as the feed will be at all times in reach of its mouth. In feeding, also, the head may be ventilated to bring the mouth some distance from the feed and near the upper portion of the bag, and this without spilling any of the feed.

SPRING DRAUGHT ATTACHMENT.—John F. Tiner, Lavernia, Texas. This invention does away with the ordinary doubletree and provides a simple spring attachment, especially adapted for a two-horse vehicle, as it prevents the horses from pulling against one another and prevents the pole from swaying sidewise, also enabling the vehicle to run easily and without jerks. Oppositely extending arms are pivoted on the vehicle pole, singletrees being pivoted on the outer ends of the arms, and swinging open frames pivoted to a support in the rear of the singletrees, while spring repressed drawbars mounted in the frames are connected with the singletrees and arms.

TRANSOM LIFTER.—James M. Maddox, Birmingham, Ala. This is a device by means of which a person standing on the floor may easily raise and lower the transom and fasten it at any desired height. Guide pins project from the ends of the pivoted transom and work in ways in the frame in which the transom is pivoted, and the arrangement is such that the transom cannot be operated except from the side of the door on which the hand hold is located, while it may be opened slightly to give ventilation without fear of being further opened by outsiders intending to force an entrance to a room.

WINDOW SCREEN.—Willard E. Cobb, Portland, Me. This is an improvement in screens provided with springs to hold the screens at any desired height in a window. The screen frame has in one side edge a vertical groove from which extends transverse recesses, plate springs in the groove extending within the recesses, within which are spiral springs engaging the inwardly bent ends of the plate springs, the spiral springs forcing the plate springs outward at all times.

CLOTHES PIN. — Allan Watt, Rocky Mount, N. C. This is a device preferably formed of spring wire and permanently secured to the clothes line. Its body is bent into the form of a letter W, the central portion of which has at its apex a partial eye or loop embracing the line, while the upper extremities of the side limbs have eyes in which is loosely jointed a wire loop extending downward around the line.

WALLET. — George K. Morton, St. Thomas, Canada. A light, neat, and inexpensively made wallet is provided by this invention, one suitable for carrying papers, hauk bills, etc., and permitting of the ready removal or inspection of its contents. It is closed at the bottom and ends and open at the top, the sides being flexible and free from flaps, and provided with fastening devices of a novel character.

HAT CASE. — Nellie F. Hurdel, New York City. This case comprises two similar parts hinged together, a vertical frame being arranged within the case and extending around its walls, while vertically adjustable hat supporting arms have hat hangers at their inner ends. The case may be quickly and easily adjusted to receive hats of different sizes, or for either men's or women's hats, while a quantity of hats may be packed in it and carried in such a way that they cannot be injured.

TRAY.—Max S. Rosenzweig, New York City. A tray arranged to prevent glasses and other articles carried upon it from tipping over or sliding off is provided by this invention. It has flanges extending inwardly pivoted to its sides, and adapted to engage the stems of the glasses or one side of the bases of the articles held on the tray.

CANE CUTTER. — Frederick B. Alexander, Brooklyn, N. Y. This invention relates to cutters for shaping cane, rattan, or similar material, for use in the manufacture of furniture, carriages, etc., shaping the strands so that when one is split longitudinally it will afford two workable strands. The die stock has an attaching shank and a cut away or reduced portion embraced by a knife with cconcave cutting edge forming an oval passage, and imparting a half oval form to the flat side of the cane, which is fed by rollers in the usual way.

TOY.—George W. Snaman, Jr., Allegheny, Pa. This is a novel device for the amusement and instruction of children, and consists of a small cabinet holding pictures which are spring-pressed upwardly, each slide being held depressed by sets of rods that extend to letters on a forward alphabet board. When the rods which restrain a picture slide are properly operated to spell the name of the picture, the slide is released and moved upwardly to show the picture.

DESIGN FOR A SPOON.—James N. Van Slyke, Madison, Wis. The handle of a spoon is, according to this design, ornamented with the figure of an eagle, the design embracing features commemorative of the eagle "Old Abe," which accompanied a Wisconsin regiment through the war of the rebellion.

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BUILDING EDITION.

AUGUST NUMBER.—(No. 82.)

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(4483) H. J. W. writes: Kindly tell me which is the strongest, a piece of solid ¾ steel of any length, or a piece of the same steel, of the same diameter and length, with a ¼ inch hole bored entirely through it, and also why is it the strongest? A. The solid rod would be the stronger of the two because it contains more material.

(4484) G. H. S. writes: 1. I have a small electric fan motor wound for four volts and requiring three amperes to run it, also a small electric lighting plant run by a storage battery. I find if I connect all the cells, 50 volts, with the motor, through a resistance, it requires 3 amperes, and if I connect the motor with only 2 cells and no resistance, it requires 3 amperes also, giving me about the same speed in each case. How does the first method compare with the second in economy, or how much do I lose by the first method compared with the second? A. The entire question is one of resistance and electromotive force. The current is controlled by Ohm's law. Probably there is no appreciable difference between the two methods of running the motor. 2. If I used the first method, would the whole battery become exhausted as quickly as the two cells would in the second method? A. No. 3. If I used the second method, when the two cells were exhausted I would have to recharge in order to bring the voltage up to run the lamps; now would it take as long to recharge the battery in series, until the two cells were charged as much as the remainder, as it would if all the cells had been exhausted as much as the two that were running the motor? A. It will take as much time to charge the two cells separately as will be required to charge the whole series. It is not advisable to use a portion of a storage battery, allowing the remainder to stand unused, as it is extremely difficult afterward to charge them so that they will all have the same electromotive force.

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(4485) C. C. and G. W. say: Please explain the objects and purposes of fly wheels on mechanical devices. Are they intended to give certain velocity of speed, or are they only intended to control velocity? A. Fly wheels are mainly regulators of speed during a revolution by absorbing the power in momentum during the high pressure part of the stroke and giving out power by its momentum during the expansion period and the passage of the centers in power engines. In other applications, as in punching, shearing and pressing machines, it becomes an accumulator of power, by which a small constant power is made to do a vastly larger instantaneous work by the momentum of a fly wheel under continuous motion. In general terms the fly wheel is a regulator of speed during a revolution, but does not control the number of revolutions per minute, as this is due to the relation of the power to the work. In this sense it acts as an accumulator and transmitter of power through the momentum of a heavy weight revolving with a variable velocity.

(4486) W. W. S. says: A party says a level is a surface or line every part of which is equally distant from the earth's center. Second party says it is not, holding that as you descend or ascend from the surface of the ocean, you do not then have a true level. Is a mechanical level or a scientific level, used for engineering or other purposes, a curved line? All leveling in engineering and surveying is done by straight lines. There are no instrumental curves. A geodetic level is a curved line following the earth's surface at the mean level of the sea as a datum. In engineering surveys of a long line, the series of levels are straight lines, which are reduced by computation to form a polygonal figure corresponding with the curvature of the earth.

(4487) G. B. B. asks whether there is any instrument made to determine altitude. Or, describe the general plan of determining heights above sea level. A. The barometer (aneroid) is the usual instrument for determining elevations above the sea. The temperature of boiling water is also used. Triangulation and leveling from tide water is the most accurate, when the distance is not too great, yet very accurate work may be done in this way, even across the continent. You will find the details in works on surveying. The United States geodetic survey is progressing on the method of triangulation.

(4488) J. N. R. writes: Please let me know how many gravity cells (Crowfoot) are needed to run a fan about 5 inches in diameter. How should I charge them, how much bluestone, how often, when fan is run 5 hours a day? A. The number of cells required to run the fan depends upon its resistance and the velocity of the fan. You will be obliged to use a sufficient number of cells to overcome the resistance, and then you will have to add cells in parallel until you get the power you need. Gravity batteries when first charged should be filled one-third full of crystals of copper sulphate; the cells should then be filled to a point just above the zinc with a weak solution of sulphate of zinc or Glauber's salt. It should then stand on a closed circuit for a few hours, the circuit to include resistance a little greater than the total resistance of the battery cells.

(4489) H. H. R. asks: How can I prevent the zincs from corroding in a battery composed of sulphuric acid and water in the glass jar and a solution of common salt and water in the porous cup? A. To prevent the rapid corrosion of your zincs you should thoroughly amalgamate them. This you can accomplish by dipping them in dilute sulphuric acid, sprinkling them with a few small drops of mercury and rubbing them on the surface plate until the plate is perfectly covered.

(4490) J. L. M. writes: Every man owning a horse should know how a horse should be shod; instructing a smith how you want it done as a general thing will not do. One must stand by and see it done properly. A smith should never be allowed to cut the frog under any circumstances. If it is diseased and requires cutting it should be done by a competent farrier. The outside of the hoof should not be rasped, not even under the nail clinch. Shoes that confine the edges of the hoof are extremely injurious. Also in regard to erysipelas, he writes that he has found painting the affected spot with tincture of iodine and then covering it with collodion effects a cure.

(4491) J. H. asks: 1. How are the copper strips of the commutator brushes joined in the motor, SUPPLEMENT, No. 641? A. The copper strips are joined by soft solder at the outer ends. 2. Where could I get description of a battery that would run the motor, and what kind would be the best? A. You will find a description of such a battery as you require in SUPPLEMENT, No. 792.

(4492) H. H. writes: Why in winding an armature do you always say cut and afterward solder to commutator the outside end of coil to inside end of next coil, etc.? Why not make a loop instead of cutting the wire, and cut the insulation, and solder the wire at end of loop. A. It would be difficult to form a loop of exactly the right length. There is no objection to the loop, but it does not appear to have any advantage.

(4493) A. H. asks: Will it hurt a shunt motor to run it empty any length of time? A. A shunt motor will not be injured by running idle, as no current of any amount is generated unless the external circuit is closed.

(4494) W. R., Zurich, asks: Can you through the Notes and Queries column of your valuable paper tell me the flashing point of naphtha which has a specific gravity of 0·68? Can you tell me if naphtha of 0·68 can light itself in tropical heat if exposed to sunshine in an open basin? A. Naphtha as light as you state cannot be trusted at any temperature above congelation which is below 0° Fah. Its vapor is the most inflammable of all the hydrocarbons. It will flash at all atmospheric temperatures. It will not flash under the direct rays of the sun, tropical or otherwise, but will evaporate very fast under the action of the sun in open vessels.

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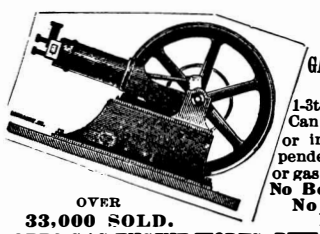
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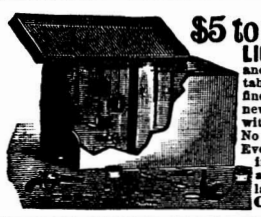
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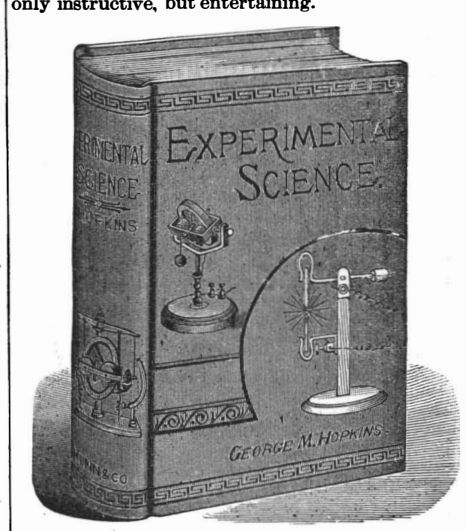

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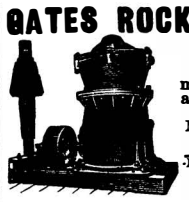

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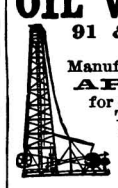

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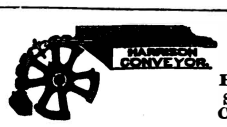

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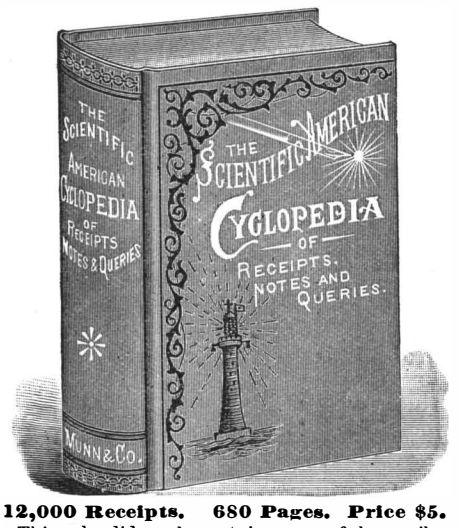

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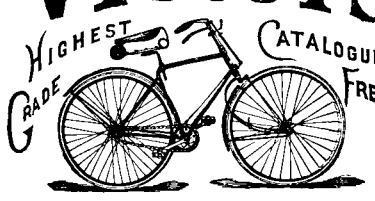

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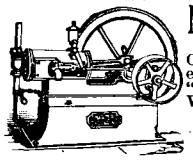
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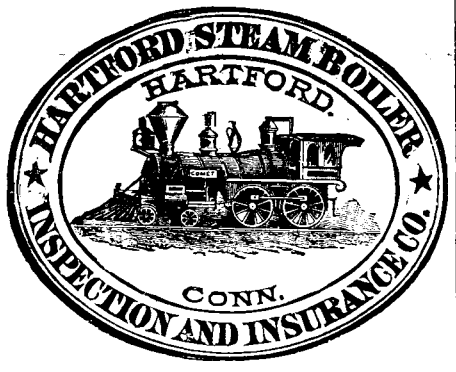

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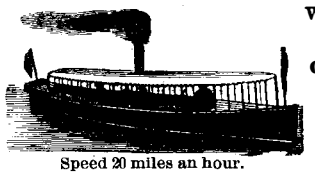
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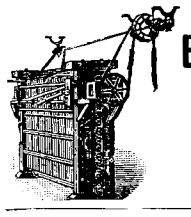

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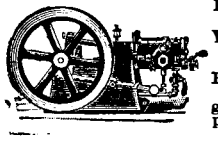

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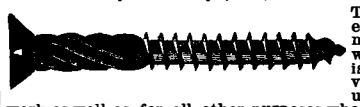

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